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Yee et al.

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(54) **SYSTEMS AND METHODS FOR IMMERSIVE VIEWING EXPERIENCE**

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(51) **Int. Cl.**

G06F 3/00	(2006.01)
G06F 13/00	(2006.01)
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H04N 7/16	(2011.01)
H04N 7/173	(2011.01)
H04N 21/485	(2011.01)

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CPC ***H04N 21/485*** (2013.01); ***H04N 21/21805*** (2013.01); ***H04N 21/4728*** (2013.01); ***H04N 21/6587*** (2013.01); ***H04N 21/84*** (2013.01)

(58) **Field of Classification Search**

USPC 725/37, 38, 59, 60, 62, 116

See application file for complete search history.

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Primary Examiner — Pinkal R Chokshi
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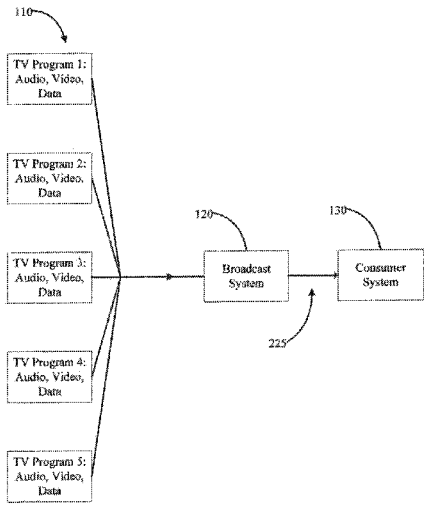
(57) **ABSTRACT**

Described herein are methods and systems that may help to provide selectable viewing options for a television program. An exemplary method involves: (i) receiving a television video transport stream comprising video content associated with a particular television program, wherein the television video transport stream comprises focal-point metadata regarding at least one focus point, wherein the at least one focus point corresponds to a sub-frame within at least one frame of the video content, (ii) receiving focal-point input data indicating a zoom request, (iii) processing video content in response to the focal-point input data, and (iv) generating a television video output signal comprising video content that is zoomed to the sub-frame, wherein the television video output signal is configured to be displayable on a graphic display.

25 Claims, 14 Drawing Sheets



(51) **Int. Cl.**

H04N 21/218	(2011.01)
H04N 21/4728	(2011.01)
H04N 21/6587	(2011.01)
H04N 21/84	(2011.01)

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Invitation to Pay Additional Fees and, Where Applicable, Protest Fee and Communication Relating to the Results of the Partial International Search dated Feb. 20, 2015 in International Application No. PCT/US2014/066202 filed Nov. 18, 2014 by Woei-Shyang Yee et al.

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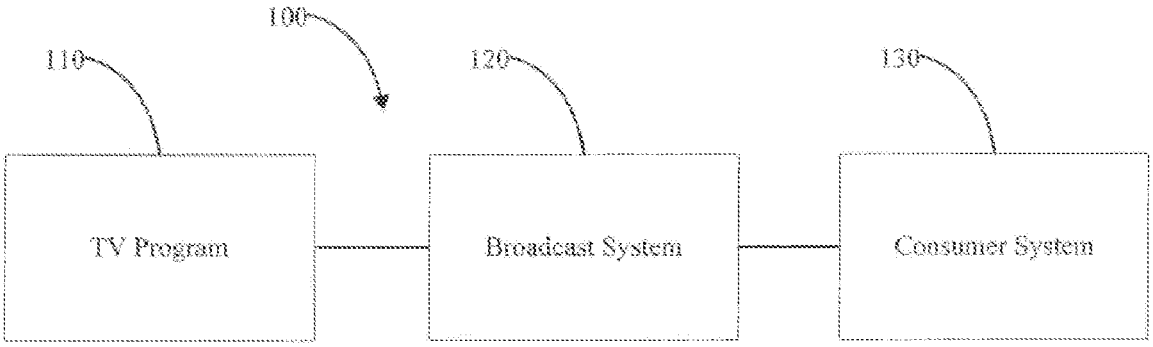
100
110
120
130
TV Program
Broadcast System
Consumer System

FIG. 1

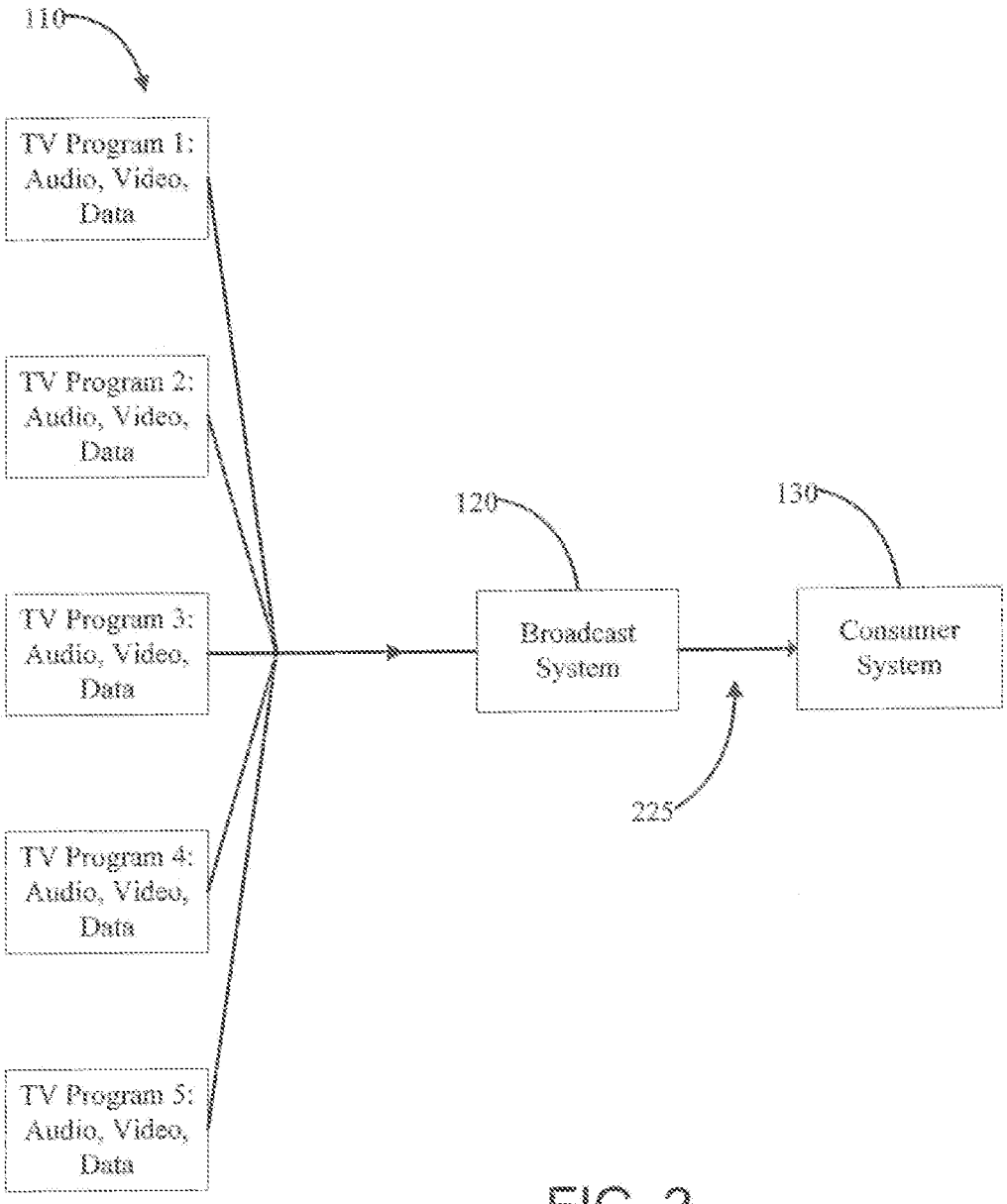
110
TV Program 1: Audio, Video, Data
TV Program 2: Audio, Video, Data
TV Program 3: Audio, Video, Data
TV Program 4: Audio, Video, Data
TV Program 5: Audio, Video, Data
120
Broadcast System
130
Consumer System
225

FIG. 2

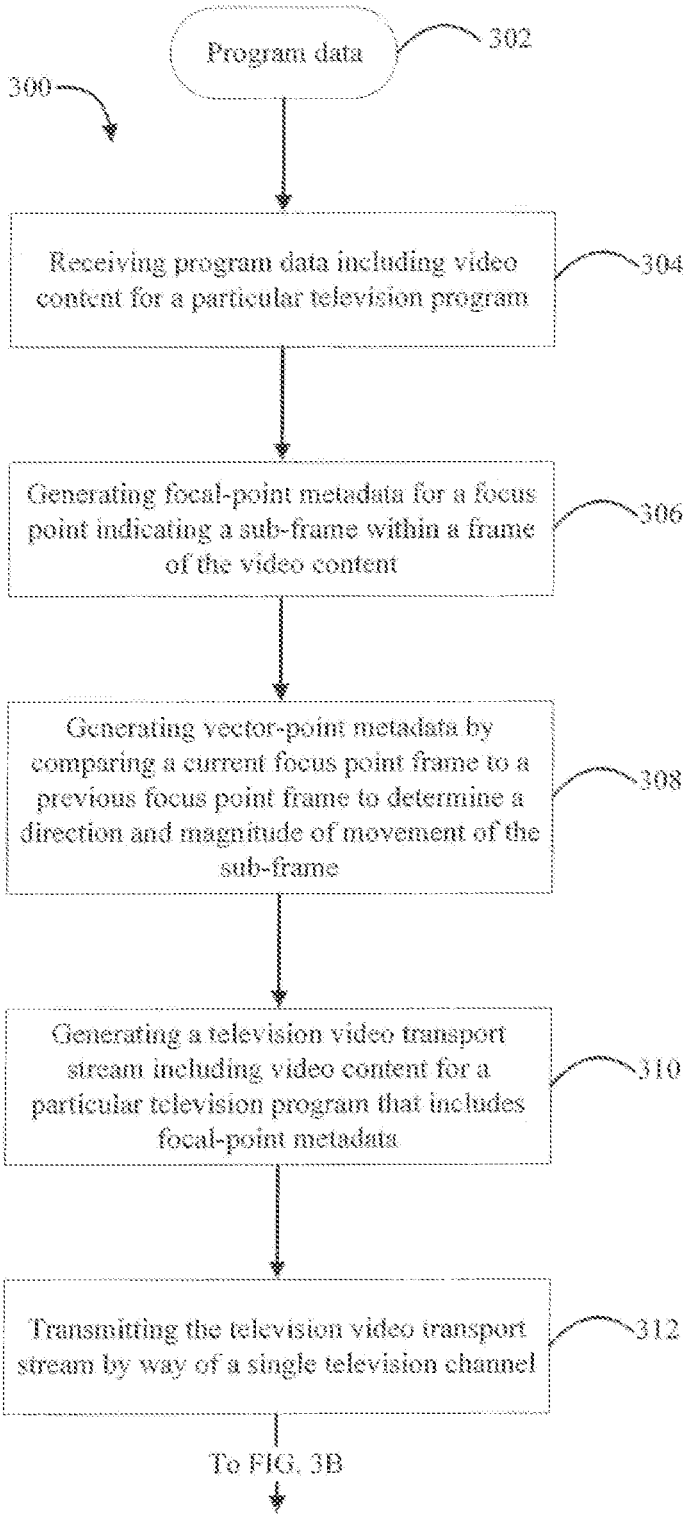
Program data
302
300
Receiving program data including video content for a particular television program
304
Generating focal-point metadata for a focus point indicating a sub-frame within a frame of the video content
306
Generating vector-point metadata by comparing a current focus point frame to a previous focus point frame to determine a direction and magnitude of movement of the sub-frame
308
Generating a television video transport stream including video content for a particular television program that includes focal-point metadata
310
Transmitting the television video transport stream by way of a single television channel
312
To FIG. 3B

FIG. 3A

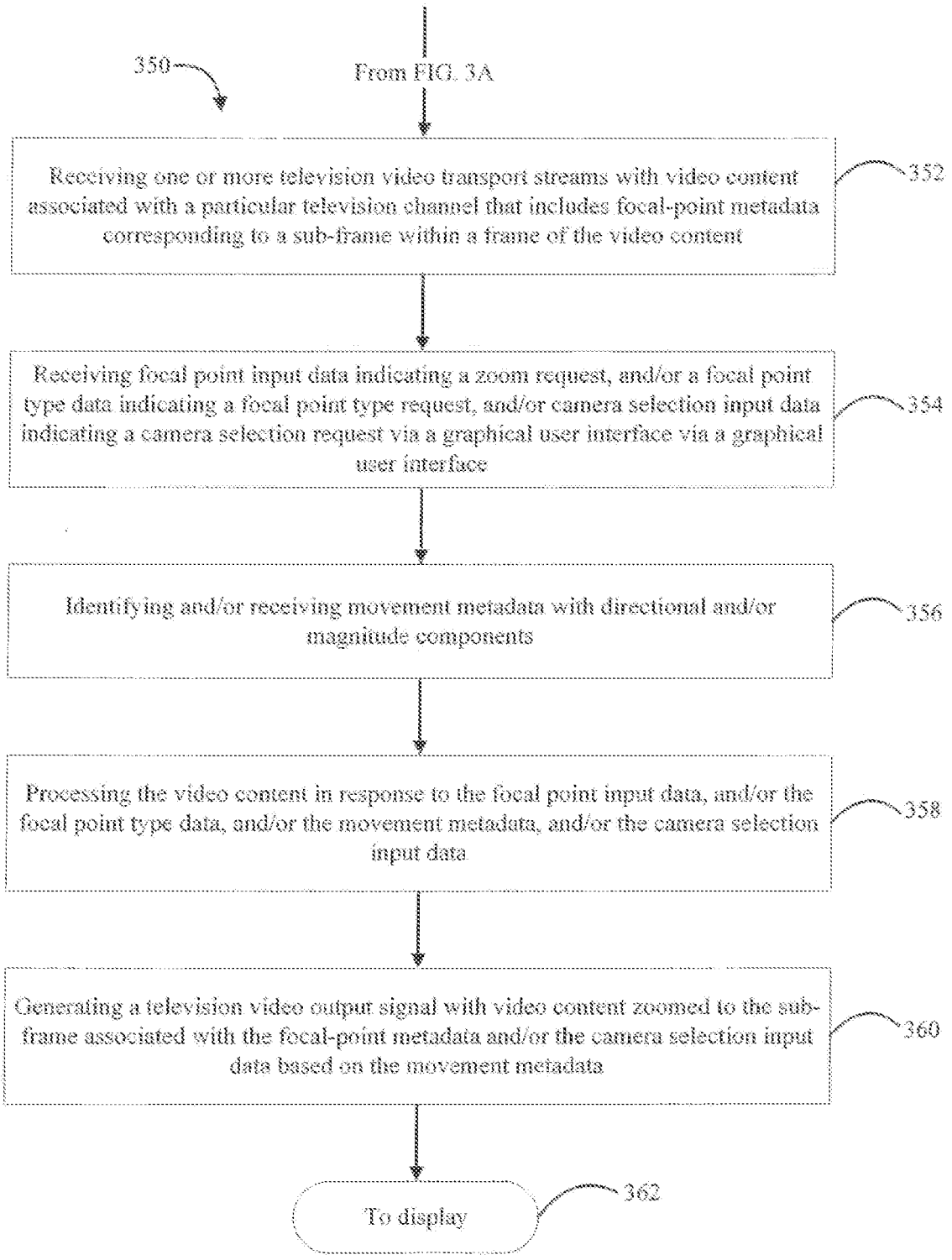
350
From FIG. 3A
Receiving one or more television video transport streams with video content associated with a particular television channel that includes focal-point metadata corresponding to a sub-frame within a frame of the video content
352
Receiving focal point input data indicating a zoom request, and/or a focal point type data indicating a focal point type request, and/or camera selection input data indicating a camera selection request via a graphical user interface via a graphical user interface
354
Identifying and/or receiving movement metadata with directional and/or magnitude components
356
Processing the video content in response to the focal point input data, and/or the focal point type data, and/or the movement metadata, and/or the camera selection input data
358
Generating a television video output signal with video content zoomed to the sub-frame associated with the focal-point metadata and/or the camera selection input data based on the movement metadata
360
To display
362

FIG. 3B

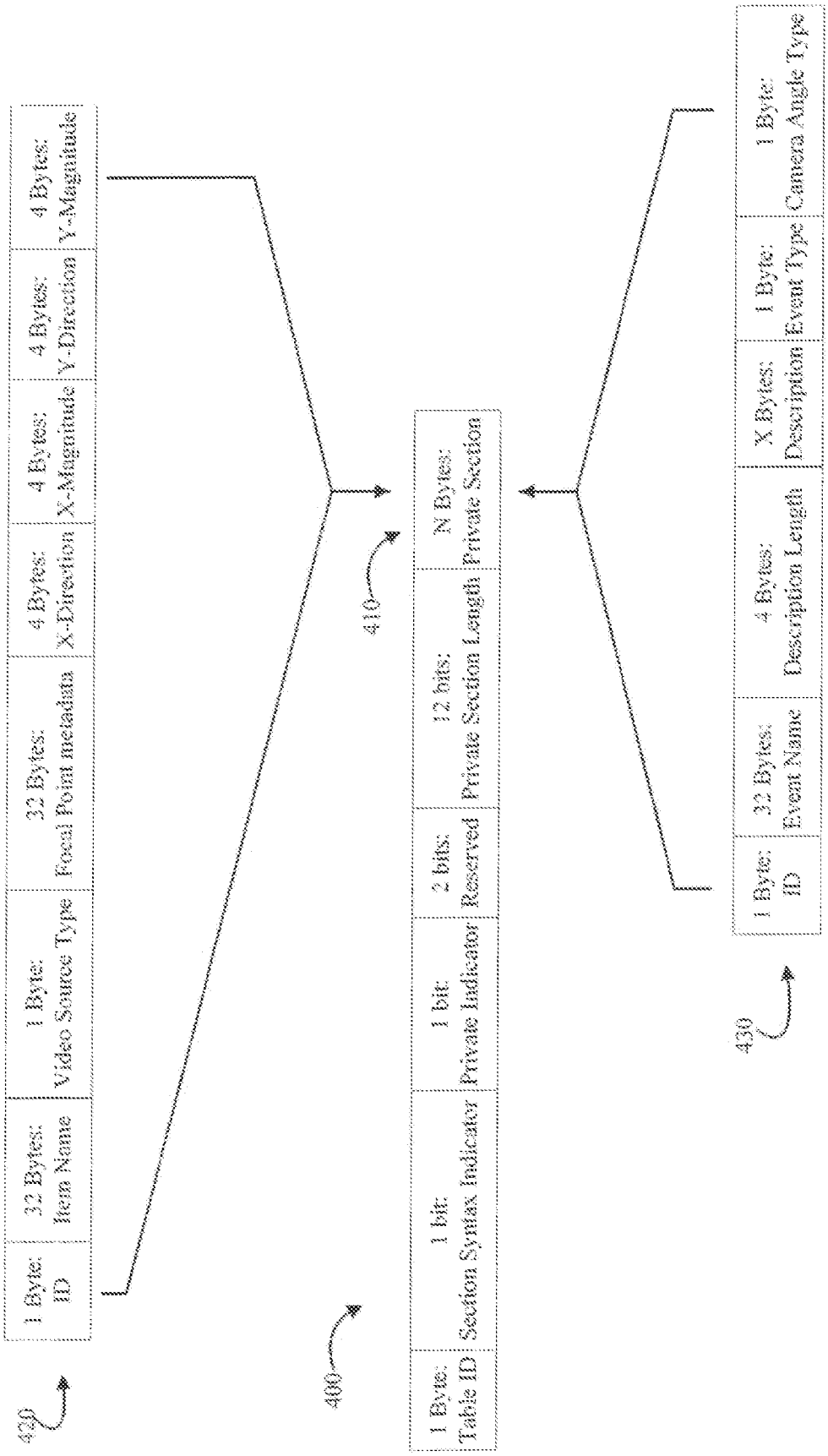
1 Byte: ID
32 Bytes: Item Name
1 Byte: Video Source Type
32 Bytes: Focal Point metadata
4 Bytes: X-Direction
4 Bytes: X-Magnitude
4 Bytes: Y-Direction
4 Bytes: Y-Magnitude
420
1 Byte: Table ID
1 bit: Section Syntax Indicator
1 bit: Private Indicator
2 bits: Reserved
12 bits: Private Section Length
N Bytes: Private Section
400
410
1 Byte: ID
32 Bytes: Event Name
4 Bytes: Description Length
X Bytes: Description
1 Byte: Event Type
1 Byte: Camera Angle Type
430

FIG. 4

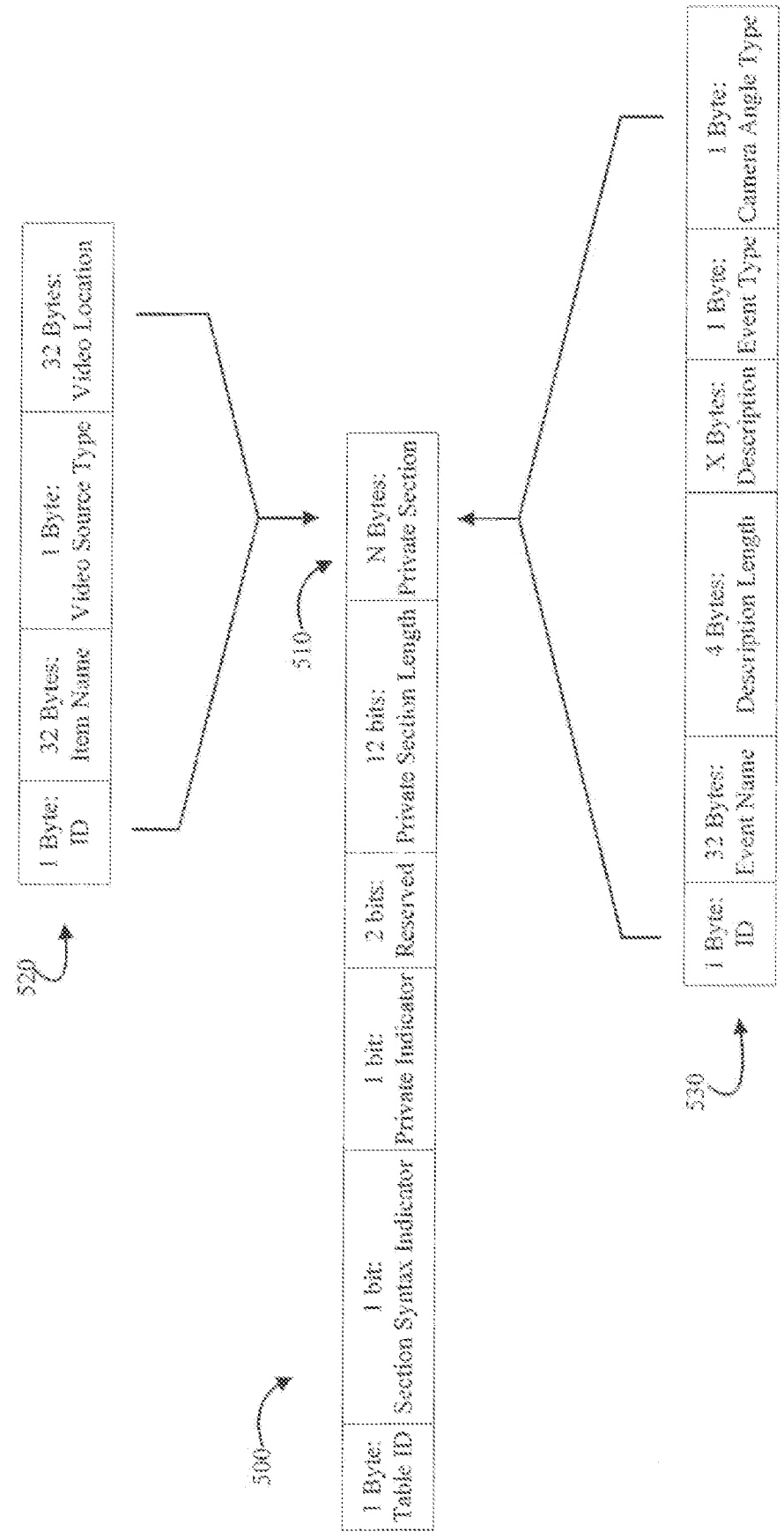
500
1 Byte: Table ID
1 bit: Section Syntax Indicator
1 bit: Private Indicator
2 bits: Reserved
12 bits: Private Section Length
N Bytes: Private Section
510
520
1 Byte: ID
32 Bytes: Item Name
1 Byte: Video Source Type
32 Bytes: Video Location
530
1 Byte: ID
32 Bytes: Event Name
4 Bytes: Description Length
X Bytes: Description
1 Byte: Event Type
1 Byte: Camera Angle Type

FIG. 5

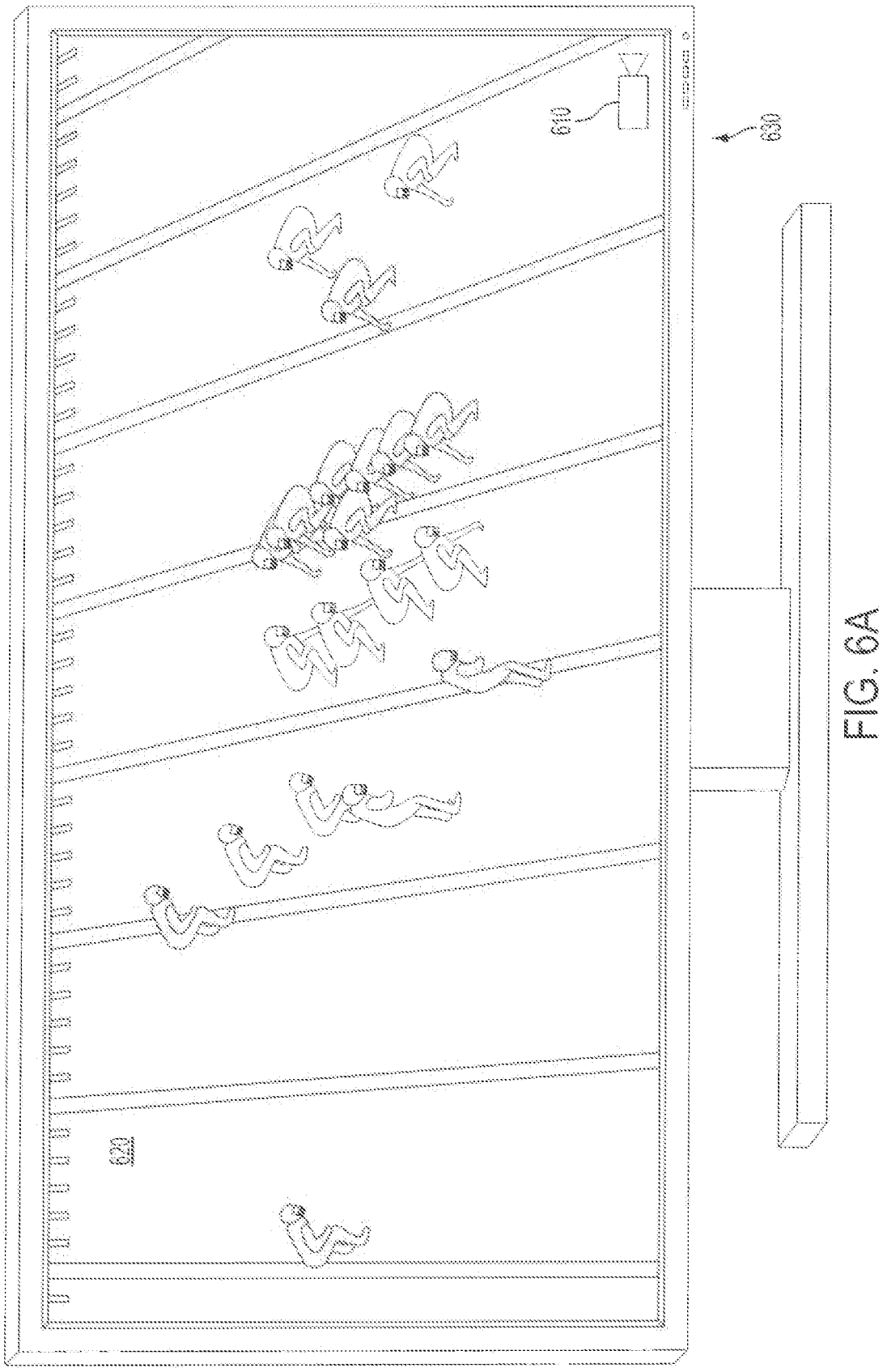

FIG. 6A

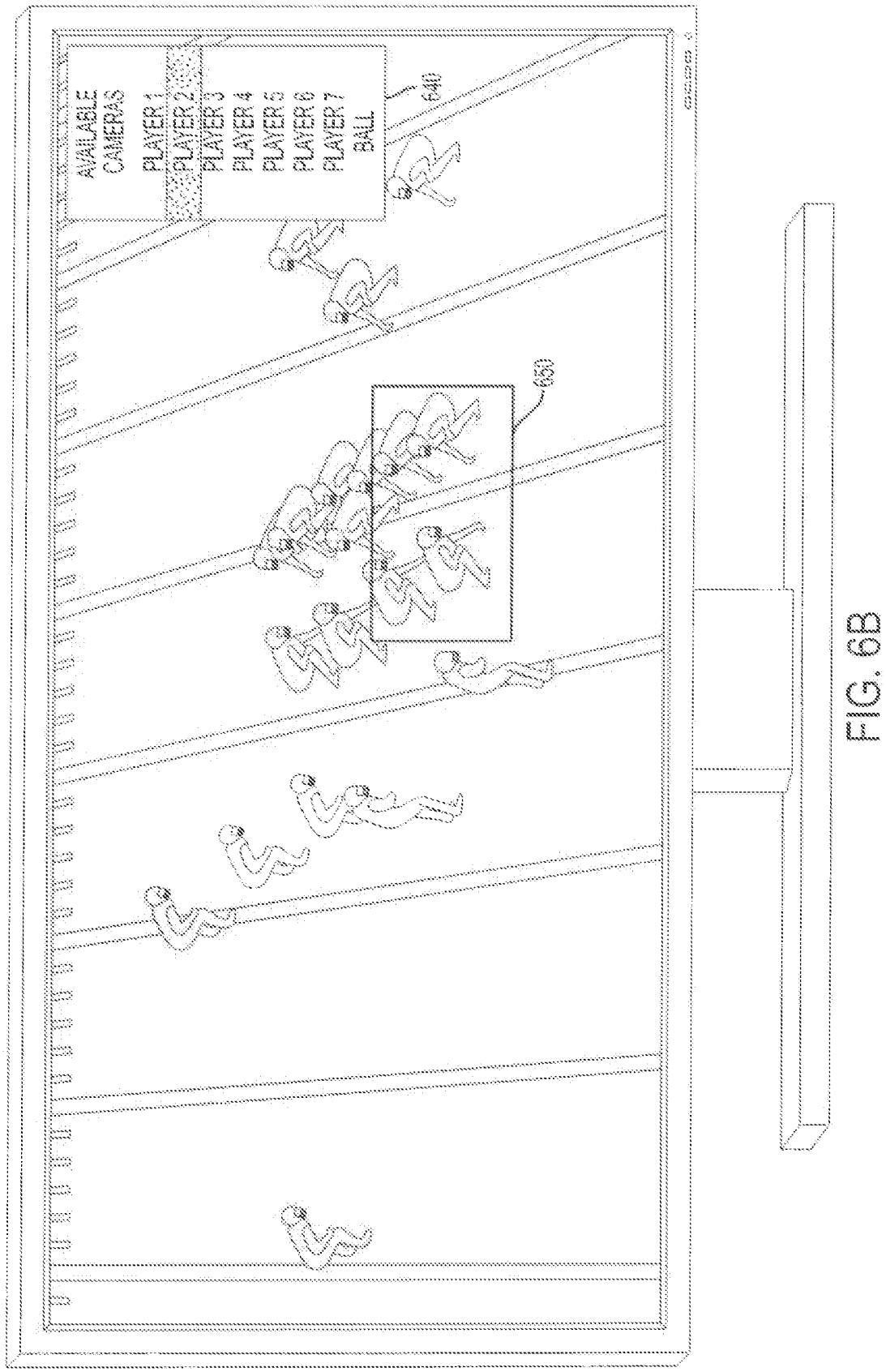
AVAILABLE CAMERAS
PLAYER 1
PLAYER 2
PLAYER 3
PLAYER 4
PLAYER 5
PLAYER 6
PLAYER 7
BALL
640
650

FIG. 6B

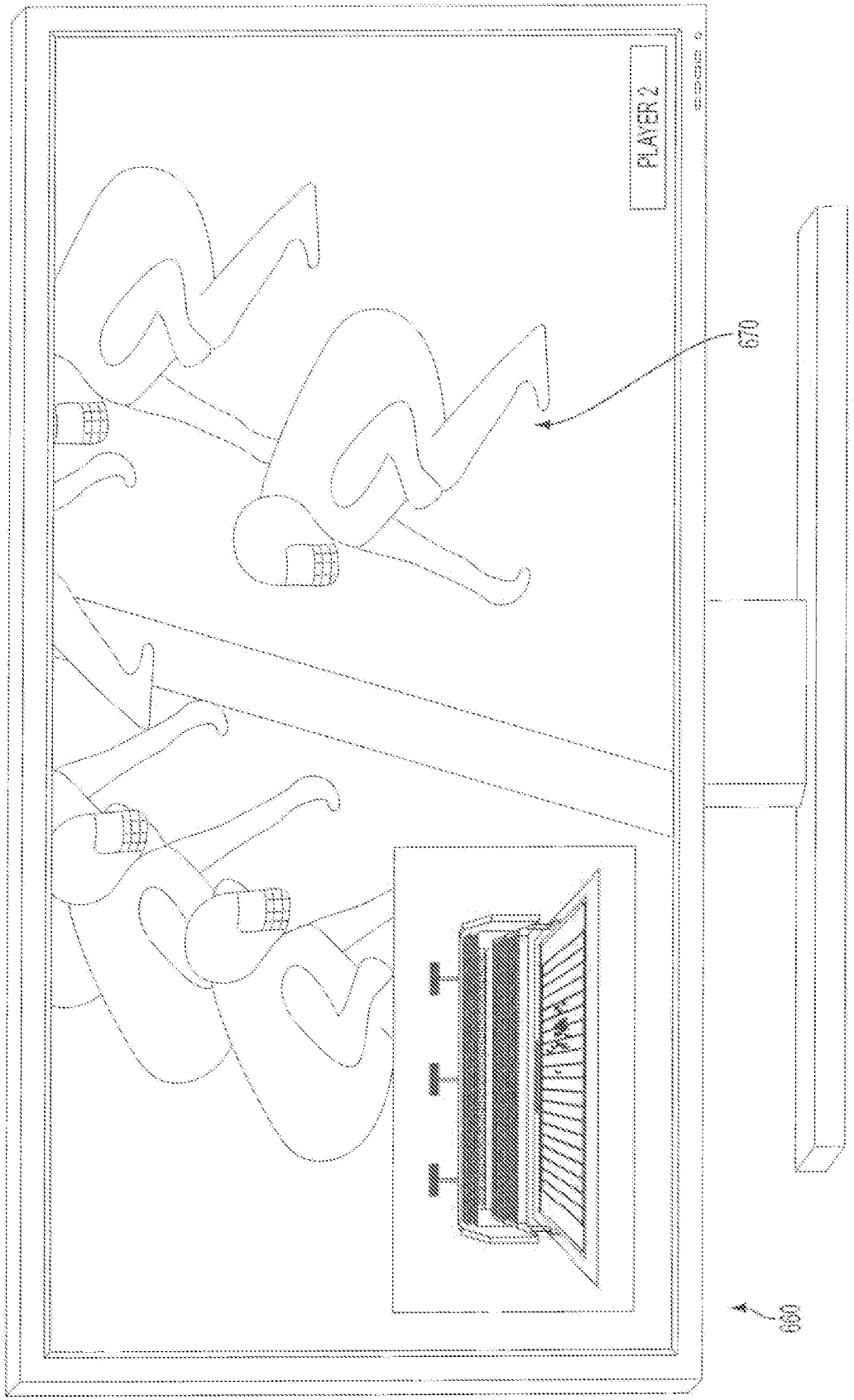

FIG. 6C

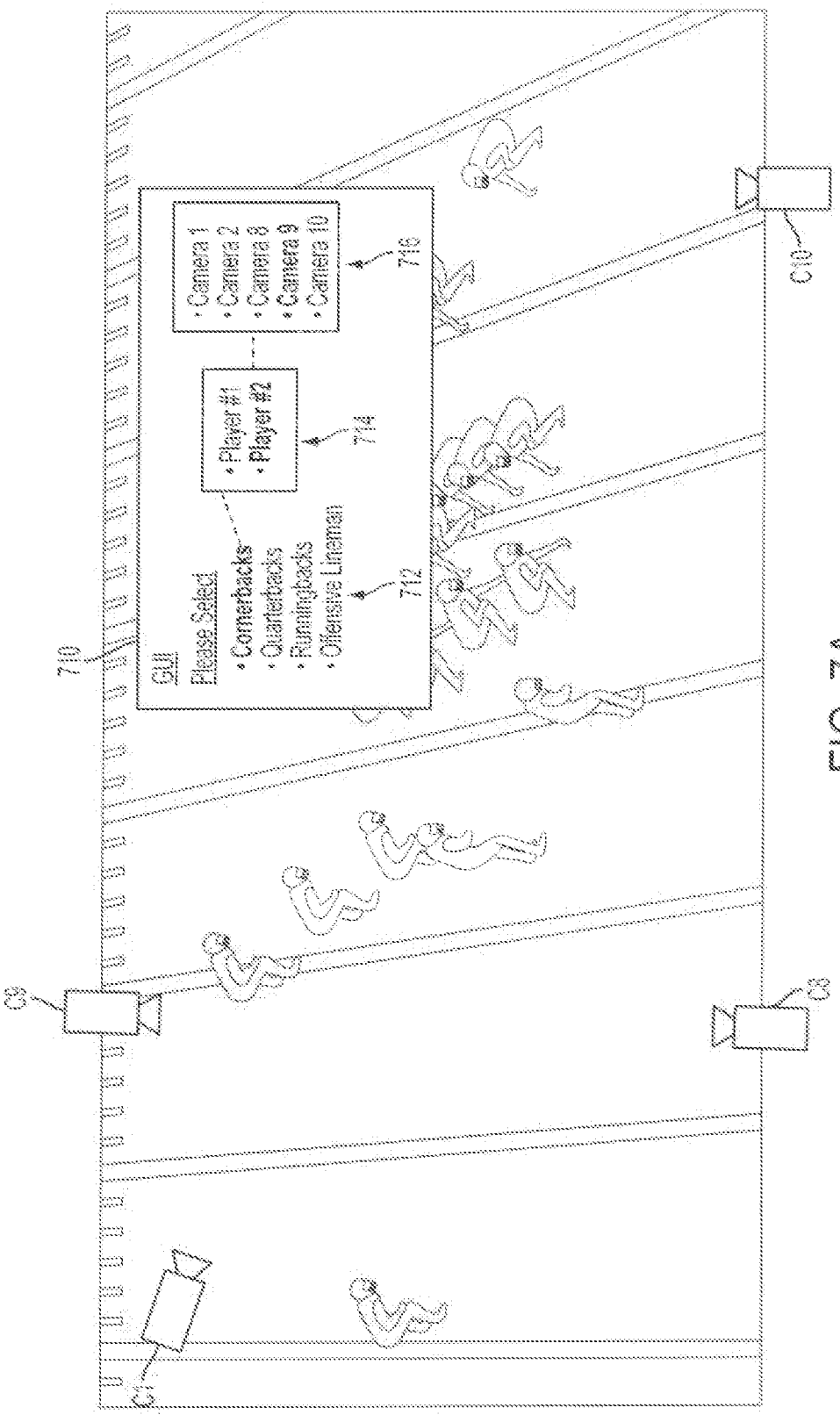
GUI
Please Select
• Cornerbacks
• Quarterbacks
• Runningbacks
• Offensive Lineman
712
• Player #1
• Player #2
714
• Camera 1
• Camera 2
• Camera 8
• Camera 9
• Camera 10
716
710
C10
C8
C3
C1

FIG. 7A

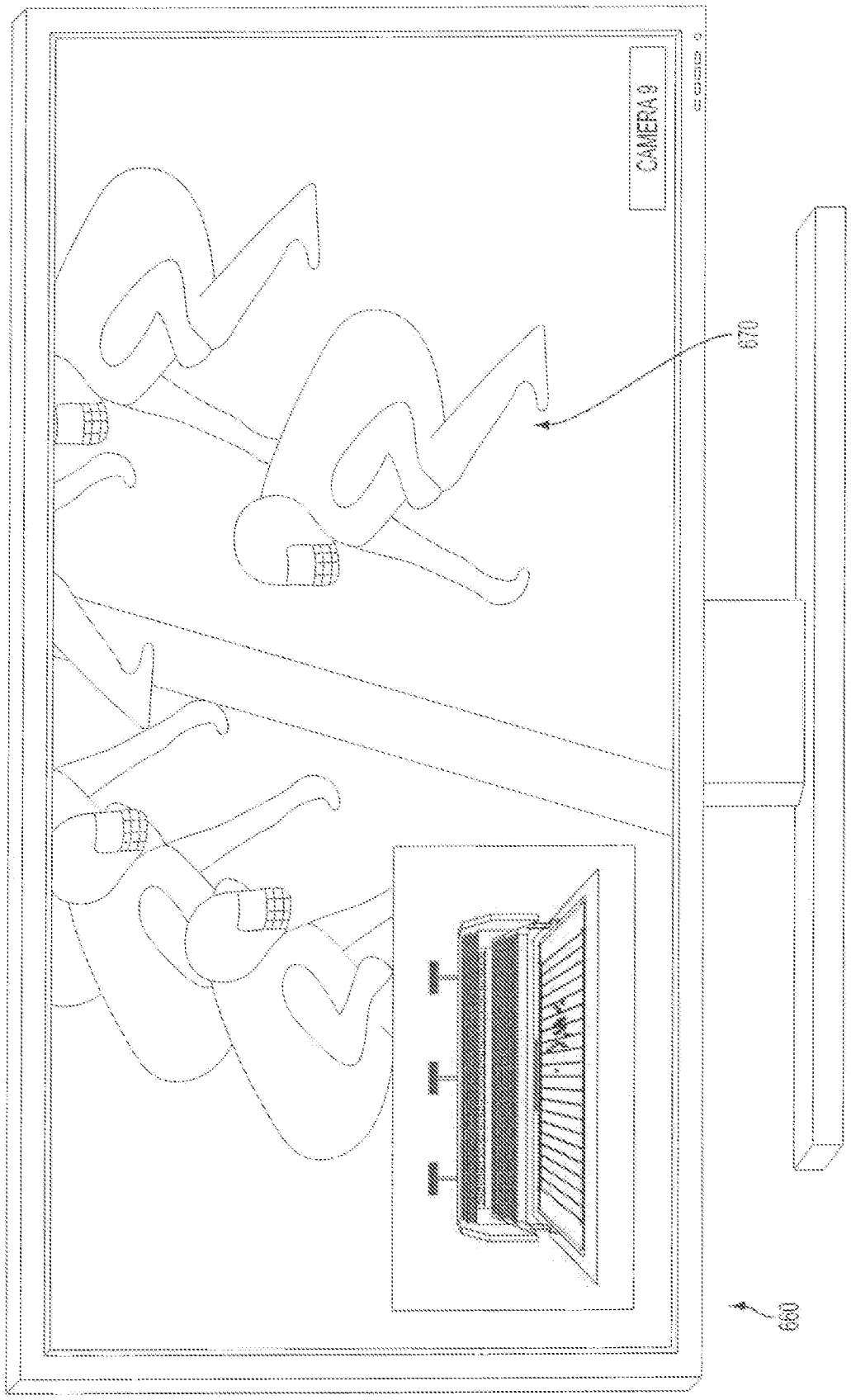

FIG. 7B

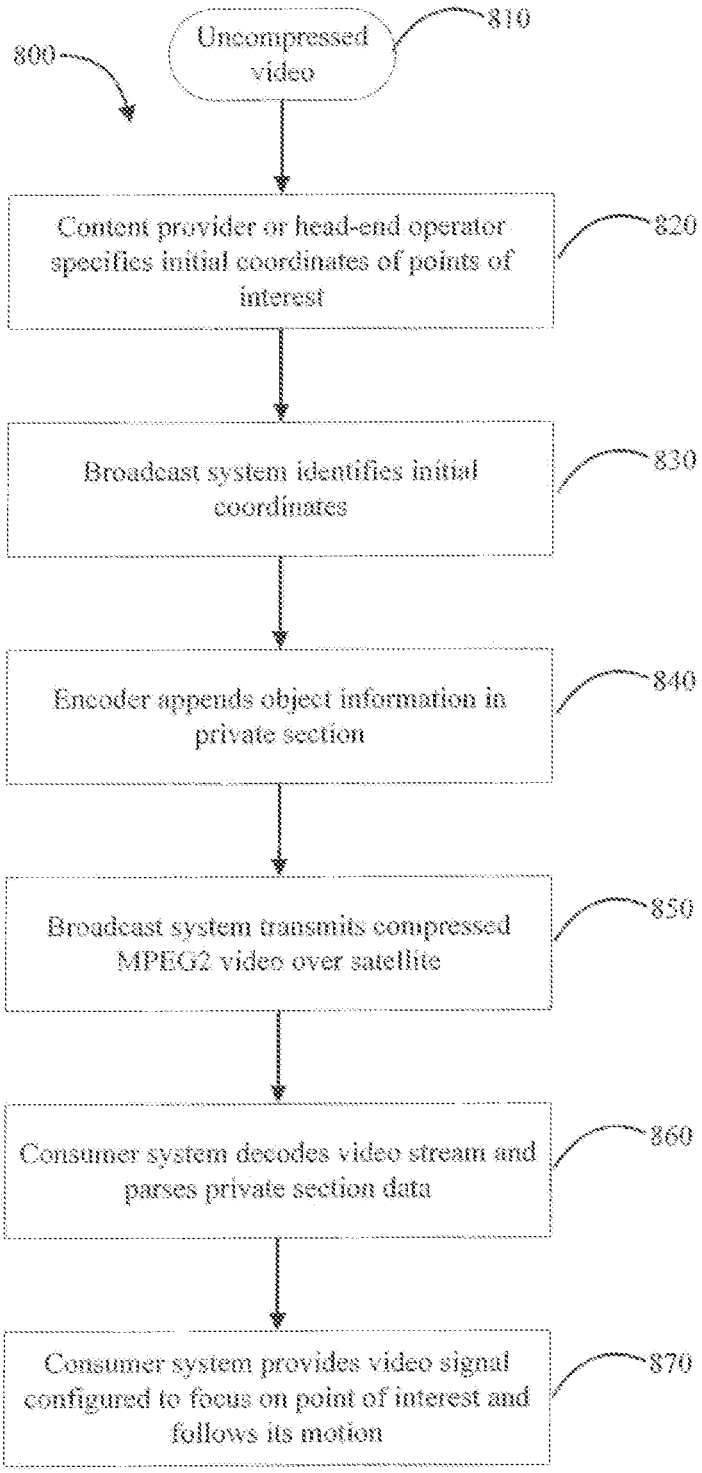
800
Uncompressed video
810
Content provider or head-end operator specifies initial coordinates of points of interest
820
Broadcast system identifies initial coordinates
830
Encoder appends object information in private section
840
Broadcast system transmits compressed MPEG2 video over satellite
850
Consumer system decodes video stream and parses private section data
860
Consumer system provides video signal configured to focus on point of interest and follows its motion
870

FIG. 8

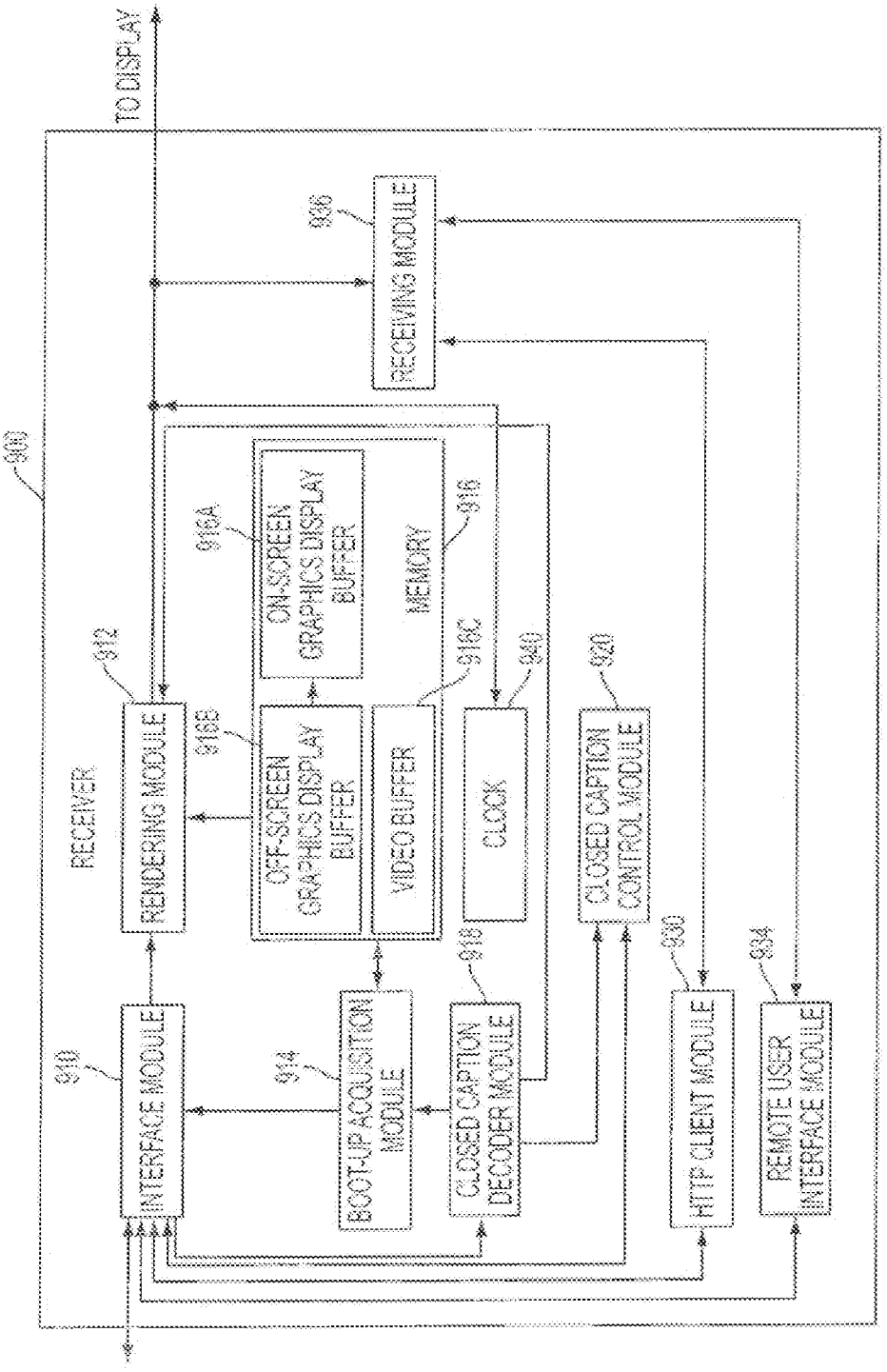
TO DISPLAY
900
RECEIVER
906
RECEIVING MODULE
916A
ON-SCREEN GRAPHICS DISPLAY BUFFER
916
MEMORY
912
916B
916C
940
920
RENDERING MODULE
OFF-SCREEN GRAPHICS DISPLAY BUFFER
VIDEO BUFFER
CLOCK
CLOSED CAPTION CONTROL MODULE
910
914
916
900
934
INTERFACE MODULE
BOOT-UP ACQUISITION MODULE
CLOSED CAPTION DECODER MODULE
HTTP CLIENT MODULE
REMOTE USER INTERFACE MODULE

FIG. 9

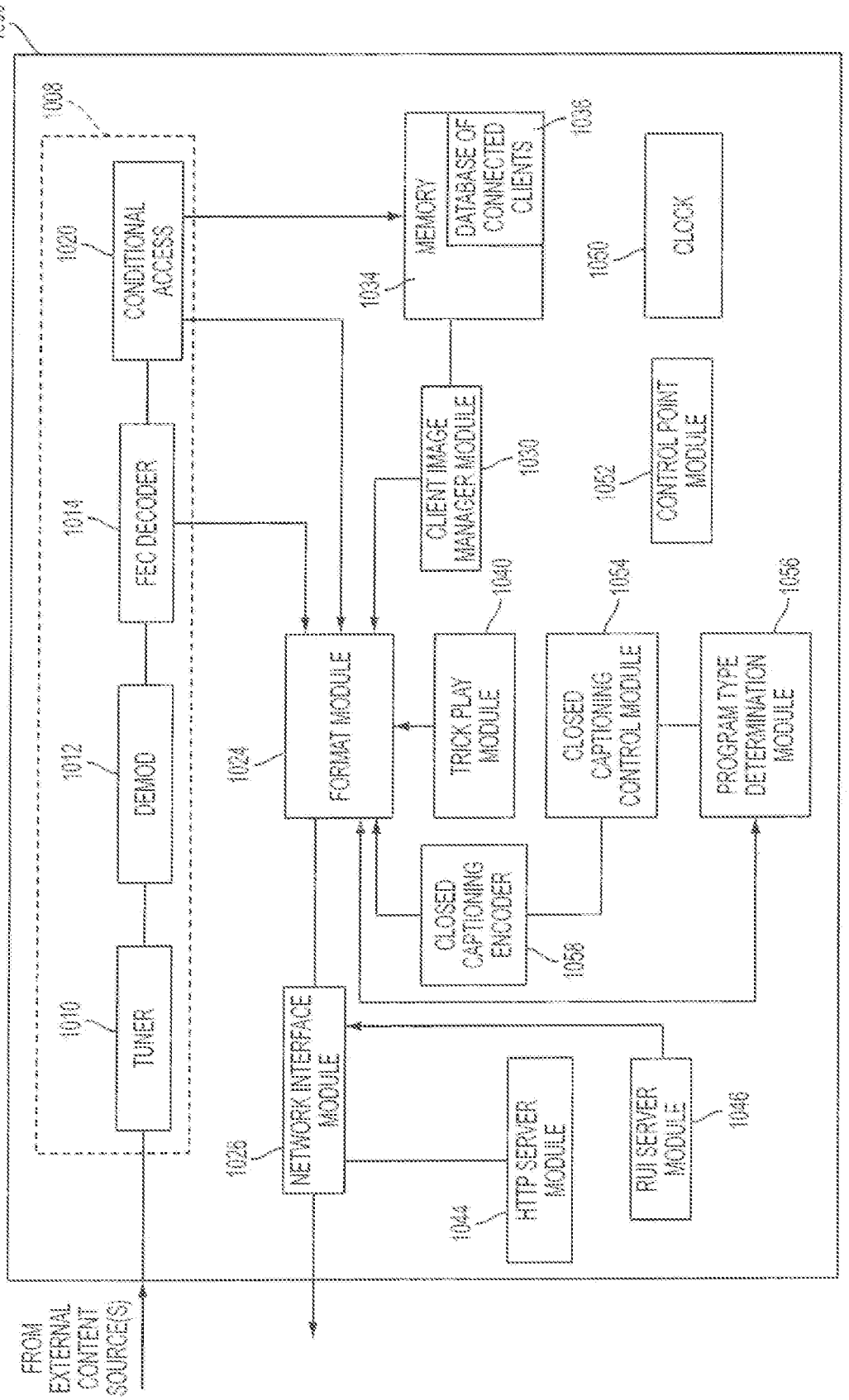
1000
1008
1020
CONDITIONAL ACCESS
1014
FEC DECODER
1012
DEMOD
1010
TUNER
FROM EXTERNAL CONTENT SOURCE(S)
1034
MEMORY
DATABASE OF CONNECTED CLIENTS
1036
1050
CLOCK
CLIENT IMAGE MANAGER MODULE
1030
1052
CONTROL POINT MODULE
1024
FORMAT MODULE
1040
TRICK PLAY MODULE
1054
CLOSED CAPTIONING CONTROL MODULE
1056
PROGRAM TYPE DETERMINATION MODULE
CLOSED CAPTIONING ENCODER
1026
NETWORK INTERFACE MODULE
1044
HTTP SERVER MODULE
RUI SERVER MODULE
1046

FIG. 10

SYSTEMS AND METHODS FOR IMMERSIVE VIEWING EXPERIENCE

BACKGROUND

Generally, a television broadcast system provides video, audio, and/or other data transport streams for each television program. A consumer system, such as a tuner, a receiver, or a set-top box, receives and processes the transport streams to provide appropriate video/audio/data outputs for a selected television program to a display device (e.g., a television, projector, laptop, tablet, smartphone, etc.).

The transport streams may be encoded. For instance, some broadcast systems utilize the MPEG-2 format that includes packets of information, which are transmitted one after another for a particular television program and together with packets for other television programs. Metadata related to particular television programs can be included within a packet header section of an MPEG-2 packet. Metadata can also be included in separate packets of an MPEG-2 transmission (e.g., in MPEG-2 private section packets, and and/or in an advanced program guide transmitted to the receiver). This metadata can be used by the consumer system to identify, process, and provide outputs of the appropriate video packets for each selectable viewing option.

SUMMARY

Example embodiments may help to provide selectable television viewing options; for example, by allowing a user to zoom in on different points of interest in a television program. Illustratively, a video stream that is broadcast on a particular television channel may provide a wide field of view of a baseball game, such as an overhead view of the playing field. Provided with an example embodiment, a user may be able to select a point interest in the video stream, such as the current batter, and the receiver will zoom in on the point of interest and provide a video output with the point of interest featured or centered in the display. In a further aspect, a user interface may allow a user to select the particular points of interest that the user would like to zoom in on. The user interface, in one example, can be a graphical user interface that is provided on the display, although, other examples are also possible.

Further, to facilitate such functionality, a television service provider's system may insert focus-point metadata into the video stream. A focus point may be a coordinate pair in the video frame that is updated to follow the point of interest as it moves within the video frame. As such, a coordinate pair for a given frame of the video content may indicate a sub-frame within the given frame, such that the receiver can determine an appropriate area in each frame to zoom in on. Accordingly, in response to receiving a request to zoom to a point of interest, a consumer system, such as a set-top box, may process the video content to generate video content that is zoomed in on a sub-frame surrounding the point of interest.

In one aspect, an example method involves receiving a television video transport stream with video content associated with a particular television channel, where the television video transport stream includes focal-point metadata regarding one or more focus points that follow the point of interest, where a focus point is a coordinate that follows the point of interest and indicates a sub-frame within a frame of the video content. In response to receiving a request to zoom to a point of interest, the video content is processed, and a television signal is generated with video content that is zoomed to the sub-frame.

In another aspect, an example method involves receiving two or more television video transport streams with video content for a particular program. The two or more television video transport streams include video content associated with two or more different camera views of the particular television program, and at least one of the television video transport streams includes a focus point that follows a point of interest and indicates a sub-frame at least one frame of the video content. Then a camera selection request is received or a zoom request is received. In response to one or both of the camera selection request or the zoom request, the video content is processed and a television video output signal is generated that is associated with one or both of the camera selection request or the zoom request.

In a further aspect, an example method involves receiving two or more television video transport streams with video content for a particular program. The two or more television video transport streams include video content associated with two or more different camera views of the particular television program. After identifying the different camera views, a camera selection request is received. In response to the camera selection request, the video content is processed and a television video output signal is generated with video content that is associated with the camera selection request.

In yet another aspect, an example method involves receiving streaming data comprising video content associated with at least one live stream for a particular television program and generating a focus point that follows a point of interest and indicates a sub-frame within at least one frame of the video content. Then, a television video transport stream is generated with video content that includes the focus point that follows the point of interest, and the television video transport stream is transmitted by way of a single television channel.

These as well as other aspects, advantages, and alternatives, will become apparent to those of ordinary skill in the art by reading the following detailed description, with reference where appropriate to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating a television system, according to an example embodiment.

FIG. **2** is another block diagram illustrating a television system, according to an example embodiment.

FIG. **3**A illustrates an example embodiment of a broadcast system **120**;

FIG. **3**B illustrates an example embodiment of a consumer system **130**;

FIG. **4** illustrates a metadata structure providing data regarding a focus point and movement data and, in particular, for Ultra HD video streams;

FIG. **5** illustrates a data format for identifying metadata within a packetized system and, in particular, a data format for standard definition and high definition video streams;

FIGS. **6**A, **6**B, and **6**C illustrate an example display with a graphical user interface for zooming in on different points of interest of a video stream;

FIGS. **7**A and **7**B illustrate an example display with a graphical user interface for zooming in on different points of interest of a video stream.

FIG. **8** illustrates another method designed for implementation with an MPEG-2 transport stream.

FIG. **9** illustrates a simplified block diagrammatic view of a receiver, according to an example embodiment.

FIG. **10** illustrates a simplified block diagrammatic view of a server, according to an example embodiment.

DETAILED DESCRIPTION

Exemplary methods and systems are described herein. It should be understood that the word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any embodiment or feature described herein as "exemplary" or as an "example" is not necessarily to be construed as preferred or advantageous over other embodiments or features. The exemplary embodiments described herein are not meant to be limiting. It will be readily understood that certain aspects of the disclosed systems and methods can be arranged and combined in a wide variety of different configurations, all of which are contemplated herein.

Additionally, the particular arrangements shown in the Figures should not be viewed as limiting. It should be understood that other embodiments may include more or less of each element shown in a given Figure. Further, some of the illustrated elements may be combined or omitted. Yet further, an exemplary embodiment may include elements that are not illustrated in the Figures.

I. OVERVIEW

Example embodiments may help television content broadcasters and/or satellite or cable television providers to provide a user with selectable viewing options for a television program. For example, example embodiments may allow viewers to selectively track different points of interest in the television program. As a specific example, example embodiments may allow a user to track particular players in a sporting event or to track a particular item or object, such as a football, hockey puck, soccer ball, etc., which is used in the sporting event. The viewing options can also or alternatively include video from different camera locations and angles. Other examples are possible.

In example embodiments, the metadata can include video coordinates for different focus points within the video stream, where the focus points follow a point of interest and correspond to a sub-frame within a frame of video content. To facilitate selectable zooming, focus points can be defined by the broadcasters and/or by the satellite/cable television operators as video coordinates. Further, the video coordinates for the focus point can take various forms, such as a pair of (X_1, Y_1), (X_2, Y_2) coordinates that define opposing corners of a video box, or a single coordinate (X_1, Y_1) that defines a center of the focus point and where the video box can be a predefined or adjustable size.

In a further aspect, to facilitate zooming in on different points of interest, metadata can also track movement of the focus point. This movement metadata may include X-Y direction and magnitude data (e.g., X and Y vector data). Generally, the receiver can generate the vector data by processing subsequent video frames to determine the direction and magnitude of movement for the point of interest. The receiver can use such movement metadata to track the point of interest and provide a smooth video output with the point of interest featured or centered in the display.

The viewing options can also or alternatively provide a selection of multiple camera views; for instance, multiple views of the playing field in a sporting event. Further, separate focus points corresponding to the same point of interest may be provided for video content from multiple cameras, such that a user can zoom in on the same point of interest from multiple different camera views. In other words, although a point of interest (e.g., Player **2**) is the same regardless of camera selection, each camera may have different focus points, or coordinates, that follow the respective point of interest and correspond to a sub-frame within a frame of the video content. Thus, after focusing on a particular player in a sporting event, a graphical user interface may be displayed that provides a selection of all cameras capable of focusing on that particular player.

Such selectable viewing options can be provided through different video streams that are provided synchronously via a single television channel. Illustratively, the television program can be a football game and the video streams for the football game can include a first camera view from behind an end zone, a second camera view from midfield, a third camera view that focuses on the football, and one or more other camera views that focus on specific players, player positions, or others (e.g., cornerbacks, the quarterback, running backs, coaches, band members, people in the stands, etc.). The video packets for each video stream are associated with camera view metadata so that the receiver can retrieve the appropriate video packets to display. As discussed generally above, the present disclosure contemplates a user interface through which a user can select one or more of the video streams to display. The selected video stream(s) can be displayed in a number of different ways, such as displaying a single selected video stream on the entire display or displaying different video streams in a picture-in-picture (PIP) arrangement or a split-screen arrangement.

The examples described above and throughout this description are provided for explanatory purposes and are not intended to be limited. It should be understood that variations on these examples, and different examples, are also possible.

II. EXEMPLARY TELEVISION SYSTEMS

Turning now to FIG. **1**, the reference numeral **100** generally indicates a system overview for broadcast television. A television program **110** may also be referred to as a television show, and may include a segment of content that can be broadcast on a television channel. There are may types of television programs **110**, such as animated programs, comedy programs, drama programs, game show programs, sports programs, and informational programs. Television programs **110** can be recorded and broadcast at a later date. Television programs **110** may also be considered live television, or broadcast in real-time, as events happen in the present. Television programs **110** may also be distributed, or streamed, over the Internet. In an exemplary embodiment, the television programs may further include various points of interest, such as actors, athletes, and stationary objects such as a football, baseball, and goal posts, which can be zoomed in on using focus points that correspond to each point of interest.

Television programs **110** are generally provided to consumers by way of a broadcast system **120** and consumer system **130**. There are many different types of broadcast systems **120**, such as cable systems, fiber optic systems, satellite systems, and Internet systems. There are also a variety of consumer systems **130**, including set-top box systems, integrated television tuner systems, and Internet-enabled systems. Other types of broadcast systems and/or consumer systems are also possible.

Turning now to FIG. **2**, the broadcast system **120** may be configured to receive video, audio, and/or data streams related to a television program **110**. The broadcast system **120** may also be configured to process the information from that television program **110** into a transport stream **225**. The transport stream **125** may include information related to more than

one television program **110** (but could also include information about just one television program **110**). The television programs **110** are generally distributed from the broadcast system **120** as different television channels. A television channel may be a physical or virtual channel over which a particular television program **110** is distributed and uniquely identified by the broadcast system **120** to the consumer system **130**. For example, a television channel may be provided on a particular range of frequencies or wavelengths that are assigned to a particular television station. Additionally or alternatively, a television channel may be identified by one or more identifiers, such as call letters and/or a channel number.

In an example embodiment, a broadcast system **120** may transmit a transport stream to the consumer system **130** in a reliable data format, such as the MPEG-2 transport stream. However, other formats for a transport stream are also possible. A transport stream may specify a container format for encapsulating packetized streams (such as encoded audio or encoded video), which facilitates error corrections and stream synchronization features that help to maintain transmission integrity when the signal is degraded.

FIGS. **3**A and **3**B illustrate methods according to example embodiments. The methods **300** and **350** may be implemented by one or more components of the system **100** shown in FIG. **1**, such as broadcasting system **120** and/or consumer system **130**. At block **302**, program data associated with a television program **110** is created. The program data is in the form of audio, video, and/or data associated with a television program **110**. Examples of data associated with a television program include electronic programming guide information and closed captioning information.

At block **304**, the broadcasting system **130** receives program data for a particular television program **110**. At block **306**, focal-point metadata is generated for a focus point that follows a point of interest and indicates a sub-frame within a frame of the video content from the program data. For example, the focal-point metadata may indicate a pair of coordinates that defines a sub-frame that is centered on the focal point. As a specific example, the focal-point metadata may be defined as (X_1, Y_1), (X_2, Y_2). Alternatively, the focal-point metadata may indicate a focal point (X_1, Y_1), such that a sub-frame of a pre-defined size can be centered on the focal point.

In an example embodiment, the broadcast system **120** may also generate movement data to anticipate movement of the point of interest and, correspondingly, the focus point. Such movement data may help to improve the picture quality when a user is viewing a sub-frame for a particular focus point that follows a particular point of interest. The movement data may be transmitted by the broadcast system **120** to the consumer system **130** in the form of a motion vector for the available points of interest. The point of interest may, for example, become the center or focus of the zoomed picture while the motion vector will provide direction on where the zoomed video will move until additional packets of video content are received by the consumer system **130**.

For example, at block **308**, vector metadata may be generated that indicates movement of a focus point that follows a point of interest in the sub-frame relative to the larger video frame of the video content. Such vector metadata may be generated by comparing a current focus point to a previous focus point, and determining the direction and magnitude of movement of the focus point. For example, if the focus point is defined as a center point, a direction of movement in the x-plane may be determined by subtracting a current focus point x-coordinate X_t from a previous focus pint x-coordinate X_{t-1}, where a positive result means the focus point is moving in the positive x-direction. Likewise, a magnitude of movement in the x-plane may be determined by taking the absolute value of the difference in the current focus point x-coordinate and the previous focus point x-coordinate. This approach can also be used to measure direction and magnitude of movement in other planes and for other types of metadata.

At block **310**, the broadcast system **120** generates a television video transport stream that includes video content for one or more television programs **110** and includes focal-point metadata. In an example embodiment, the television video transport stream also includes vector metadata such as a direction of movement and a magnitude of movement. At block **312**, the broadcast system **120** transmits the television video transport stream. For example, the broadcast system may transmits a television video transport stream that includes video content for one television program **110**, including focal-point metadata and/or other metadata, by way of a single television channel.

The method **350** may be implemented by one or more components of a television system, such as the broadcasting system **120** and/or the consumer system **130** shown in FIG. **1**. At block **352**, the consumer system **130** receives one or more television video transport streams with video content associated with a particular television program **110**. Each television video transport stream may include focal-point metadata, which indicates at least one focus point that follows a point of interest and indicates a sub-frame within a frame of the video content in the stream.

At block **354**, the consumer system **130** receives focal-point input data indicating a zoom request for a point of interest. For example, if the television program is a football game, the consumer system **130** may display a graphical user interface with a list of the football player's names. The user may select the desired name from the graphical display, thus indicating a zoom request for a point of interest (i.e., the football player whose name was selected), and the consumer system **130** would associate the request with the focal-point input data.

At block **356**, the consumer system **130** receives movement metadata for a focus point that indicates a direction of movement and/or a magnitude of movement, as described above, from the broadcast system **120**. Alternatively, the consumer system **130** may generate movement metadata as described above.

At block **358**, the consumer system processes **130** the video content in response to the focal-point input data and/or the movement metadata. Then, at block **360** the consumer system **130** generates a television video output signal with video content zoomed to the sub-frame associated with the focal-point metadata. In a further aspect, the consumer system **130** may improve the quality of the television video output signal by utilizing the movement metadata in combination with the focal-point input data.

At block **362**, the consumer system **130** transmits the television video output signal with zoomed video content. The television video output signal can be configured to display the signal on a graphic display in various configurations. For example, the zoomed video content could be displayed as a full-screen arrangement. Alternatively, the zoomed video content could be displayed as a split-screen arrangement or as a picture-in-picture arrangement. Higher-resolution programs, for instance UltraHD resolutions, provide even more opportunities for interesting configurations. UltraHD resolutions include resolutions for displays with an aspect ratio of at least 16:9 and at least one digital input capable of carrying and presenting native video at a minimum resolution of 3,840

pixels by 2,160 pixels. UltraHD may also be referred to as UHD, UHDTV, 4K UHDTV, 8K UHDTV, and/or Super Hi-Vision.

FIG. **4** is a block diagram illustrating packet-data formatting for a transport stream, according to an exemplary embodiment. In particular, FIG. **400** shows a data structure for a single packet **400** in a MPEG-2 transport stream, which may include standard definition or high definition video content **402** (not shown).

As shown packet **400** includes 1 byte of data that indicates a table identifier. Packet **400** further includes 1 bit of data as a section syntax indicator. The section syntax indicator may correspond to different packet structure formats. For example, a section syntax indicator value of '1' may correspond to the data format for a packet **400** as illustrated in FIG. **4**, while a section syntax indicator value of '0' may correspond to a different data format for a packet **400** that may include different data syntax. In a further aspect, the different data syntax for a packet **400** may include blocks of data corresponding to a table identifier extension, a version number, a current next indicator, a section number, a last section number, and/or error correction data as provided by the MPEG-2 standard, other standards, or other formats.

The packet **400** may further include 1 bit of data that designates a private indicator. The packet **400** may further include 2 bits of data that are reserved. The packet **400** may further include 12 bits of data that designate a private section of length N bytes. The packet **400** may further include a private section **410** of length N bytes. Within the private section **410**, two portions of data may also be included; private section item metadata **420** and private section event metadata **430**.

The private section **410** of packet **400** may be utilized to facilitate selectable viewing options at a consumer unit. For instance, in FIG. **4**, private section **410** includes focal-point metadata and/or vector metadata corresponding to one or more points of interest in the video content **402** (not shown) included in the transport stream. Such focal-point metadata and/or vector metadata may be used to facilitate a consumer system zooming in on and/or following one or more points of interest in Ultra HD video content, although other forms of video content may also be utilized.

Referring to private section **410** in greater detail, the private section item metadata **420** section of packet **400** may include 1 byte of data that corresponds to an identifier, and may include 32 bytes of data corresponding to an item name, such as a point of interest, a player's name, or an actor's name. The item name may also be presented to the user as part of a graphical user interface that allows selection of the item name.

Private section item metadata **420** may further include 1 byte of data that corresponds to the video source type. Examples of video source type may include the Internet, satellite, recorded content, cable, and/or others. Private section item metadata **420** may also include 32 bytes of data that indicate focal-point metadata. For example, focal-point metadata may include coordinates (X, Y) corresponding to a point of interest in the video content **402**. In some cases, a consumer system **130** may be configured to zoom in on a sub-frame of a predetermined size that surrounds the focal point. In other cases, the focal-point metadata in the private section **410** may indicate dimensions of the sub-frame. In yet other cases, the focal-point metadata may specify opposing corners of a sub-frame that includes a point of interest (e.g., as two coordinate pairs (X_1, Y_1) and (X_2, Y_2).

Private section item metadata **420** may also include vector metadata that indicates movement (or predicted movement) of a point of interest in video content **402**. For example, private section item metadata **420** may include 32 bytes of data that correspond to a direction of movement in the x-direction, 32 bytes of data that correspond to a magnitude of movement in the x-direction, 32 bytes of data that correspond to a direction of movement in the y-direction, and 32 bytes of data that correspond to a magnitude of movement in the y-direction.

Note that the type of data included in the private section **410** may vary and/or include different types of data. Further, the size of the fields shown in private section **410** may vary, depending upon the particular implementation. Further, in some embodiments, focal-point metadata and/or vector metadata may be included as part of an electronic programming guide or advanced programming guide, which is sent to the consumer system **130**, instead of being included in an MPEG-2 transport stream.

Still referring to private section **410**, the private section **410** may further include private section event metadata **430**. The private section event metadata **430** may include 1 byte of data that corresponds to an identifier and 32 bytes of data that indicate an event name. Private section event metadata **430** may further include 4 bytes of data that designate the length X of a description, followed by X bytes of data that provide the description of the video content (e.g., a name of and/or a plot description of a television program). Private section event metadata **430** may also include 1 byte of data that indicates an event type. Examples of event types for television include a movie, sports event, and news, among other possibilities. In addition, private section event metadata **430** may include 1 byte of data that indicates a camera angle type.

In a further aspect, packet **400** may include data that facilitates error detection. For example, the last 32 bytes of packet **400** may include data that facilitates a cyclic redundancy check (CRC), such as points of data sampled from packet **400**. A CRC process may then be applied at the consumer system, which uses an error-detecting code to analyze the sampled data and detect accidental changes to the received packet **400**.

Additionally or alternatively, private section **510** may include additional or different data. The packet **500** has the same general structure as packet **400** but packet **500** may include data related to identification of multiple camera views and a selection of one of those views. For example, FIG. **5** shows a private section **510** with 32 bytes of data indicating the video location (e.g., a video location corresponding to a particular television channel, television frequency, or website universal resource locator).

Referring now to FIGS. **6**A to **6**C, these figures illustrate a scenario in which an exemplary graphical user interface may be provided, which allows a user to select viewing options corresponding to different points of interest in a television program.

Specifically, in FIG. **6**A, an icon **610** is displayed in order to notify a viewer that different interactive viewing options are available. In particular, icon **610** may be displayed over video content **620** in a display **630** when focal-point metadata and/or vector metadata is available, such that the viewer can access a graphical user interface (GUI) to select particular points of interest in the video content **620** to zoom in on and follow. When the icon **610** is displayed, the user may provide input (e.g., by clicking a button on a remote control) in order to access a GUI for selectable viewing options. When a consumer system receives such input, the consumer system may display the GUI on the display **630**.

In FIG. **6**B, the GUI **640** for selectable viewing options is being displayed on the display **630**. The GUI **640** provides a user with the option of selecting a point of interest from

multiple points of interest. In the illustrated example, the points of interest include different football players and the football. Further, each point of interest (i.e., each football player and the football) may be associated with data such as focal-point metadata, movement metadata, camera metadata, and/or other types of metadata.

The user may navigate through the GUI **640** to select particular points of interest using, e.g., buttons on a remote control for the consumer system **130**. Other types of user-interface devices may also be utilized to receive such input.

In an example embodiment, the selection of a particular point of interest via the GUI **640** may be referred to as a zoom request. In the scenario illustrated in FIG. **6**B, a zoom request has been received for Player **2**. After receiving the zoom request for Player **2**, the consumer system **130** processes the video content **620** based on the zoom request (i.e., focal-point input data) and generates a television video output signal that is zoomed in on the point of interest (i.e., Player **2**).

For example, the consumer system may initially display a box **650** in the display **630**, which indicates the sub-frame surrounding a selected point of interest. The sub-frame may be defined by a coordinate pair that indicates opposing corners of the sub-frame (X_1, Y_1), (X_2, Y_2) within the particular frame of video content, which include the point of interest. Note that when a point of interest is selected via the GUI **640**, a box **650** indicating the surrounding sub-frame may or may not be displayed before zooming in on the point of interest, depending upon the particular implementation. For example, the box **650** indicating the sub-frame with the selected point of interest may be displayed momentarily, before zooming in on the sub-frame, or until further input is received from the user to confirm the zoom request. Alternatively, when a zoom request is received, the point of interest may be zoomed in on, without ever displaying a box **650** indicating the sub-frame, within the larger frame of video content.

FIG. **6**C illustrates the display **630** after the consumer system **130** has received a zoom request, and responsively zoomed in on Player **2**. In particular, once the zoom request is received, the consumer system **130** may begin processing the video content **620** in order to crop the full frames in the transport stream, and generate sub-frames as indicated by the focus-point metadata and/or vector metadata in the transport stream, which correspond to the selected point of interest (e.g., Player **2**). Accordingly, the display **630** may display a portion of each frame of video content that is zoomed in on Player **2**, effectively providing a view that follows the movements of Player **2** within the frames of the video content **620**.

In a further aspect, when a consumer system **130** zooms in on a point of interest, a picture-in-picture display arrangement **660** may be provided. For instance, as shown, a picture-in-picture display arrangement **660** may include the nearly full-screen display of the zoomed-in view of video content **620** of Player **2 670**, and the overlaid picture-in-picture display of the full-frame of video content **620** including a larger area of the playing field. In the illustrated example, the zoomed-in view of video content **620** of Player **2 670** is sized to fill the display, and the full-frame view of video content **620** including the larger area of the playing field is displayed in a picture-in-picture format that is overlaid on the zoomed-in view of video content **620** of Player **2 670**. In other embodiments, the zoomed-in view of video content **620** of Player **2 670** may be displayed in the smaller picture-in-picture format, which can be overlaid on the full-frame view of video content **620** including the larger area of the playing field. In yet other embodiments, similar content may be provided using split-screen arrangements, other types of picture-in-picture arrangements, full screen arrangements, and/or other types of arrangements.

Note that a similar viewing experience as that illustrated in FIGS. **6**A to **6**C may be provided when multiple television channels provide different camera views of the same event. In particular, each point of interest may correspond to a different camera view, which is provided on a different television channel. Accordingly, when a zoom request is received that indicates to zoom in on one of the points of interest indicated in GUI **640**, the consumer system **130** may responsively tune to the channel providing the camera view that is focused on the selected point of interest.

Referring now to FIGS. **7**A and **7**B, these figures illustrate a scenario in which an exemplary graphical user interface may be provided, which allows a user to select various viewing options from a GUI corresponding to different points of interest in a television program. Specifically, FIG. **7**A illustrates an exemplary GUI **710** for zooming in on different points of interest of a video stream. In particular, FIG. **7**A shows a television that is displaying a GUI **710** for interacting with a football game that is being broadcast live on a particular television channel. The signal stream for the particular channel may include data that can be used to provide a GUI **710** overlaid on the video of the football game.

The GUI **710** may have a first selection level **712** that is associated with metadata. For instance, the first selection level **712** may be associated with focal-point type metadata (e.g., cornerbacks, quarterback, running backs, coaches, band members, people in the stands). The consumer system **130** may receive a selection request for the first selection level **712** from the user, for example, by the user pressing a button on a remote control. FIG. **7**A represents a selection request of cornerback for the first selection level **712**.

In a further aspect, the GUI **710** may have a second selection level **714** that may be associated with metadata. For instance, the second selection level **714** may be associated with focal-point metadata. The consumer system **130** may receive a selection request for the second selection level **714** from the user, for example, by the user pressing a button on a remote control. In FIG. **7**A, for example, the second selection level **714** is associated with focal-point metadata corresponding to points of interest (e.g., Player **1**, Player **2**). FIG. **7**A illustrates a selection request of Player **1** for the second selection level **714**.

In a further aspect, the GUI **710** may have a third selection level **716** that may be associated with metadata. For instance, the third selection level **716** be associated with camera selection metadata. FIG. **7**A illustrates different cameras placed around the field with reference numerals C**1**, C**8**, C**9**, and C**10**. The consumer system **130** may receive a selection request for the third selection level **716** from the user, for example, by the user pressing a button on a remote control. In FIG. **7***a*, for example, the third selection level **716** is associated with camera selection metadata corresponding to different camera views of the event (e.g., camera **1**, camera **2**, camera **8**, camera **9**, and camera **10**). FIG. **7**A illustrates a selection request of Camera **9** for the third selection level **716**.

FIG. **7**B illustrates the result of the three selection requests of FIG. **7**A; namely, the first selection level **712** of cornerback, the second selection level **714** of Player **1**, and the third selection level **716** of Camera **9**. As shown in FIG. **7**B, Player **1** is centered or featured in a zoomed-in display from the view of Camera **9**.

Referring now to FIG. **8**, method **800** illustrates an implementation of methods **300** and **350**, which utilizes an MPEG-2 transport stream. More specifically, at block **810**,

uncompressed video is created, such as a live stream for a television program. At block **820**, a television program content provider, or a head-end operator, specifies initial coordinates of one or more focus points that follow a point of interest and movement metadata indicating movement of the point of interest. A head-end operator is a facility for receiving television program signals for processing and distribution. The television program content provider may also specify additional data, such as data related to different camera views, data related to types or classifications of points of interest, or other data. Alternatively, the uncompressed video may be received by the broadcast system **120**, and the broadcast system **120** may specify initial coordinates, and perform other functions of block **820**.

At block **830**, the broadcast system **120** identifies the initial coordinates of one or more focus points that follow one or more points of interest in a television program **110**. For example, the broadcast system **120** may use a coder-decoder, or codec, to encode the focal-point metadata, movement metadata, and/or other data. At block **840**, the broadcast system **120** compresses the uncompressed video and appends data related to the point of interest, such as focal-point metadata and movement metadata, in the private section of the MPEG-2 transport stream. The broadcast system **120** may use a codec compress the uncompressed video and to append the data related to the point of interest in the private section.

At block **850**, the broadcast system **120** transmits the compressed MPEG-2 transport stream. For example, the broadcast system **120** may transmit via a satellite television system. At block **860**, the consumer system **130** decodes the MPEG-2 transport stream and extracts the private section data, such as the data related to one or more points of interest. The consumer system **130** may be a set-top receiver that decodes the transport stream using a codec or other software. At block **870**, the consumer system **130** provides a television video output signal that is configured to focus on the point of interest and follow its motion.

Referring now to FIG. **9**, an example embodiment of a receiver is illustrated. A receiver **900** may be one portion of a consumer system **130**, as illustrated in FIGS. **1-2**. For example, a receiver **900** may be a set-top box of a consumer system. The receiver **900** may include various component modules for use within the local area network and for displaying signals. The display of signals may take place by rendering signals provided from the network. It should be noted that the receiver **900** may comprise various different types of devices or may be incorporated into various types of devices. For example, receiver **900** may be a standalone device that is used to intercommunicate between a local area network and the broadcast system **120** (e.g., a server), as illustrated in FIGS. **1-2**. The receiver **900** may also be incorporated into various types of devices such as a television, a video gaming system, a hand-held device such as a phone or personal media player, a computer, or any other type of device capable of being networked.

The receiver **900** may include various component modules such as those illustrated below. It should be noted that some of the components may be optional components depending on the desired capabilities of the receiver **900**. It should also be noted that the receiver **900** may equally apply to a mobile user system. For example, a mobile user system may include a tracking antenna to account for the mobility of a mobile user system. This is in contrast to a fixed user system that may have an antenna that may be fixed in a signal direction. The mobile user system may include systems in airplanes, trains, buses, ships, and/or other situations where it may be desirable to have mobility.

The receiver **900** may include an interface module **910**. The interface module **910** may control communication between the local area network and the receiver **900**. As mentioned above, the receiver **900** may be integrated within various types of devices or may be a standalone device. The interface module **910** may include a rendering module **912**. The rendering module **912** may receive formatted signals through the local area network that are to be displayed on the display. The rendering module **912** may place pixels in locations as instructed by the formatted signals. By not including a decoder, the rendering module **912** will allow consistent customer experiences at various consumer systems **130**. The rendering module **912** communicates rendered signals to the display of the device or an external display.

In a further aspect, the rendering module **912** may receive content, such as a video transport stream that includes video content associated with a particular television program. The video transport stream may include metadata, for example, metadata described above such as metadata related to a point of interest.

The rendering module **912** may receive data indicating a zoom request. For example, a user of the consumer system **130** may view a graphical user interface on the display and push a button on a remote control associated with the consumer system to indicate a zoom request for a point of interest. Upon receipt of the zoom request, the rendering module **912** may process the video content in response to the zoom request. For example, the rendering module **912** may generate a television video output signal that is configured to be viewable on a graphic display and includes video content that is zoomed to the point of interest chosen by the user of the consumer system **130**.

Additionally or alternatively, the receiver **900** may receive and process the video transport stream using different components or methods. For example, the receiver **900** may include a separate video processing system or component (not shown) to receive the video transport stream, to receive the data associated with the zoom request, and/or to generate a zoomed television video output signal.

A boot-up acquisition module **914** may provide signals through the interface module **910** during boot-up of the receiver **900**. The boot-up acquisition module **914** may provide various data that is stored in memory **916** through the interlace module **910**. The boot-up acquisition module **914** may provide a make identifier, a model identifier, a hardware revision identifier, a major software revision, and/or a minor software revision identifier. Additionally or alternatively, a download location for the server to download a boot image may also be provided. A unique identifier for each device may also be provided. However, the server device is not required to maintain a specific identity of each device. Rather, the non-specific identifiers may be used such as the make, model, etc. described above. The boot-up acquisition module **914** may obtain each of the above-mentioned data from memory **916**.

The memory **916** may include various types of memory that are either permanently allocated or temporarily allocated. The on-screen graphics display buffer **916**A may be either permanently allocated or temporarily allocated. The on-screen graphics display buffer **916**A is used for directly controlling the graphics to the display associated with the receiver **900**. The on-screen graphics display buffer **916**A may have pixels therein that are ultimately communicated to the display associated with the consumer system **130**.

An off-screen graphics display **916**B may be a temporary buffer. The off-screen graphics display buffer **916**B may include a plurality of off-screen graphics display buffers. The off-screen graphics display buffer **916**B may store the graph-

ics display data prior to communication with the onscreen graphics display **916**A. The off-screen graphics display buffer **916**B may store more data than that being used by the on-screen graphics display buffer **916**A. For example, the off-screen graphics display buffer **916**B may include multiple lines of programming guide data that are not currently being displayed through the on-screen graphics display buffer **916**A. The off-screen graphics display buffer **916**B may have a size that is controlled by the server device as will be described below. The off-screen graphics display buffer **916**B may also have a pixel format designated by the server device. The off-screen graphics display buffer may vary in size from, for example, hundreds of bytes to many megabytes such as 16 megabytes. The graphics buffers may be continually allocated and deallocated even within a remote user interface session.

A video buffer memory **916**C may also be included within the memory **916**. The remote user interface may provide the server with information about, but not limited to, the video capabilities of the consumer system **130**, the aspect ratio of the consumer system **130**, the output resolution of the consumer system **130**, and the resolution or position of the buffer in the display of the consumer system **130**.

A closed-caption decoder module **918** may also be included within the receiver **900**. The closed-caption decoder module **918** may be used to decode closed-captioning signals. The closed-captioning decoder module **918** may also be in communication with rendering module **912** so that the closed-captioning display area may be overlaid upon the rendered signals from the rendering module **912** when displayed upon the display associated with the receiver **900**.

The closed-captioning decoder module **918** may be in communication with the closed-captioning control module **920**. The closed-captioning control module **920** may control the enablement and disablement of the closed-captioning as well as closed-captioning setup such as font style, position, color and opacity. When a closed-captioning graphical user interface menu is desired, the closed-captioning control module **920** may generate a closed-captioning menu. The closed captioning control module **920** may receive an input from a user interface such as a push button on the receiver **900** or on a remote-control device associated with the receiver **900**.

The server device may pass control of the display to the receiver **900** for the closed-captioning menu to be displayed. The menus may be local and associated with the closed captioning control module **920**. The menus may actually be stored within a memory associated with the closed-captioning control module **920** or within the memory **916** of the receiver **900**.

When the server device passes control to the receiver **900**, the closed-captioning menu will appear on the display associated with the receiver **900**. Parameters for closed captioning, including turning on the closed-captioning and turning off the closed-captioning may be performed by the system user. Once the selections are made, the control is passed back from the receiver **900** to the server device which maintains the closed-captioning status. The server device may then override the receiver **900** when the closed-captioning is turned on and the program type does not correspond to a closed-captioning type. As will be described below, the server device may override the closed-captioning when the closed-captioning is not applicable to a program-type display such as a menu or program guide.

Communications may take place using HTTP client module **930**. The HTTP client module **930** may provide formatted HTTP signals to and from the interface module **910**. A remote user interface module **934** allows receivers **900** associated with the media server to communicate remote control commands and status to the server. The remote user interface module **934** may be in communication with the receiving module **936**. The receiving module **936** may receive the signals from a remote control associated with the display and convert them to a form usable by the remote user interface module **934**. The remote user interface module **934** allows the server to send graphics and audio and video to provide a full featured user interface within the receiver **900**. Thus, the remote user interface module may also receive data through the interface module **910**. It should be noted that modules such as the rendering module **912** and the remote user interface module **934** may communicate and render both audio and visual signals.

A clock **940** may communicate with various devices within the system so that the signals and the communications between the server and receiver **900** are synchronized and controlled.

Referring now to FIG. **10**, a server **1000** is illustrated in further detail. The server **1000** is used for communicating with all or part of consumer systems **130**, such as the receiver **900**. The server **1000** may be part of the broadcast system **120**, as illustrated in FIGS. **1-2**, and, as mentioned above, may also be used for communication directly with a display. In a further aspect, the server **1000** may be a standalone device or may be provided within another device. For example, the server **1000** may be provided within or incorporated with a standard set top box. The server **1000** may also be included within a video gaming system, a computer, or other type of workable device. The functional blocks provided below may vary depending on the system and the desired requirements for the system.

The server **1000** may be several different types of devices. The server **1000** may act as a set top box for various types of signals such as satellite signals or cable television signals. The server **1000** may also be part of a video gaming system. Thus, not all of the components are required for the server device set forth below. As mentioned above, server **1000** may be in communication with various external content sources such as satellite television, cable television, the Internet or other types of data sources. A front end **1008** may be provided for processing signals, if required. When in communication with television sources, the front end **1008** of the server device may include a tuner **1010**, a demodulator **1012**, a forward error correction (FEC) decoder module **1014** and any buffers associated therewith. The front end **1008** of the server **1000** may thus be used to tune and demodulate various channels for providing live or recorded television ultimately to the consumer system **130**. A conditional access module **1020** may also be provided. The conditional access module **1020** may allow the device to properly decode signals and prevent unauthorized reception of the signals.

A format module **1024** may be in communication with a network interface module **1026**. The format module **1024** may receive the decoded signals from the decoder **1014** or the conditional access module **1020**, if available, and format the signals so that they may be rendered after transmission through the local area network through the network interface module **1026** to the consumer system **130**. The format module **1024** may generate a signal capable of being used as a bitmap or other types of renderable signals. Essentially, the format module **1024** may generate commands to control pixels at different locations of the display.

In an example embodiment, the server **1000** receives and processes a video transport stream. For example, the format module **1024** may receive content, such as a video transport stream that includes video content associated with a particu-

lar television program. The video transport stream may include metadata, for example, metadata described previously, such as metadata related to a point of interest. The format module **1024** may generate a zoomed television video output signal, based on the received metadata, and transmit the generated television video output signal, for example, to a consumer system **130**.

Additionally or alternatively, the format module **1024** may generate metadata, for example, metadata described previously, such as metadata related to a point of interest. For example, the format module **1024** may generate a television video output signal that is configured to be viewable on a graphic display and includes video content that is zoomed to a point of interest.

Additionally or alternatively, the server **1000** may receive and process the video transport stream using different components or methods. For example, the server **1000** may include a separate video processing system or component (not shown) to receive the video transport stream, to receive the data associated with the zoom request and/or to generate a zoomed television video output signal.

The server **1000** may also be used for other functions including managing the software images for the client. A client image manager module **1030** may be used to keep track of the various devices that are attached to the local area network or attached directly to the server device. The client image manager module **1030** may keep track of the software major and minor revisions. The client image manager module **1030** may be a database of the software images and their status of update. A memory **1034** may also be incorporated into the server **1000**. The memory **1034** may be various types of memory or a combination of different types of memory. These may include, but are not limited to, a hard drive, flash memory, ROM, RAM, keep-alive memory, and the like.

The memory **1034** may contain various data such as the client image manager database described above with respect to the client image manager module **1030**. The memory may also contain other data such as a database of connected clients **1036**. The database of connected clients may also include the client image manager module **1030** data.

A trick play module **1040** may also be included within the server **1000**. The trick play module **1040** may allow the server **1000** to provide renderable formatted signals from the format module **1024** in a format to allow trick play such as rewinding, forwarding, skipping, and the like. An HTTP server module **1044** may also be in communication with the network interface module **1026**. The HTTP server module **1044** may allow the server **1000** to communicate with the local area network. Also, the HTTP server module may also allow the server **1000** to communicate with external networks such as the Internet.

A remote user interface (RUI) server module **1046** may control the remote user interfaces that are provided from the server **1000** to the consumer system **130**.

A clock **1050** may also be incorporated within the server **1000**. The clock **1050** may be used to time and control various communications with various consumer systems **130**.

A control point module **1052** may be used to control and supervise the various functions provided above within the server device.

It should be noted that multiple tuners and associated circuitry may be provided. The server **1000** may support multiple consumer systems **130** within the local area network. Each consumer system **130** may be capable of receiving a different channel or data stream. Each consumer system **130** may be controlled by the server **1000** to receive a different renderable content signal.

A closed-captioning control module **1054** may also be disposed within the server **1000**. The closed-captioning control module **1054** may receive inputs from a program-type determination module **1056**. The program-type determination module **1056** may receive the programming content to be displayed at a consumer system **130** and determine the type of program or display that the consumer system **130** will display.

The programming-type determination module **1056** is illustrated as being in communication with the format module **1024**. However, the program-type determination module **1056** may be in communication with various other modules such as the decoder module **1014**.

The program-type determination module **1056** may make a determination as to the type of programming that is being communicated to the consumer system **130**. The program-type determination module **1056** may determine whether the program is a live broadcasted program, a time-delayed or on-demand program, or a content-type that is exempt from using closed-captioning such as a menu or program guide.

When the closed-captioning exempt programming is being communicated to the consumer system **130**, a closed-captioning disable signal may be provided to the closed-captioning control module **1054** to prevent the closed-captioning from appearing at the display associated with the consumer system **130**. The closed-captioning disable signal may be communicated from the closed-captioning control module **1054** through the format module **1024** or network interface module **1026** to the consumer system **130**. The consumer system **130** may disable the closed-captioning until a non-exempt programming-type, content-type, or a closed-captioning enable signal is communicated to the consumer system **130**. For example, the consumer system **130** may disable the closed-captioning through the closed-captioning control module **920** illustrated in FIG. **9** as part of a receiver **900**.

The closed-captioning control module **1054** may also be in communication with a closed-captioning encoder **1058**. The closed-captioning encoder **1048** may encode the closed-captioning in a format so that the closed-captioning decoder module **918** of FIG. **9** may decode the closed-captioning signal. The closed-captioning encoder module **1058** may be optional since a closed-captioning signal may be received from the external source.

IV. CONCLUSION

In some embodiments, any of the methods described herein may be provided in a form of instructions stored on a non-transitory, computer readable medium, that when executed by a computing device, cause the computing device to perform functions of the method. Further examples may also include articles of manufacture including tangible computer-readable media that have computer-readable instructions encoded thereon, and the instructions may comprise instructions to perform functions of the methods described herein.

The computer readable medium may include non-transitory computer readable medium, for example, such as computer-readable media that stores data for short periods of time like register memory, processor cache and Random Access Memory (RAM). The computer readable medium may also include non-transitory media, such as secondary or persistent long term storage, like read only memory (ROM), optical or magnetic disks, compact-disc read only memory (CD-ROM), for example. The computer readable media may also be any other volatile or non-volatile storage systems. The computer readable medium may be considered a computer readable storage medium, for example, or a tangible storage medium.

In addition, circuitry may be provided that is wired to perform logical functions in any processes or methods described herein.

The above detailed description described various features and functions of the disclosed system, devices, and methods with reference to the accompanying figures. While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

What is claimed is:

1. A method, comprising:

receiving a television video transport stream comprising video content associated with a particular television program, wherein the television video transport stream comprises focal-point metadata indicating at least one dynamic focus point for a zoom function in the video content, wherein the at least one dynamic focus point corresponds to a first sub-frame within a first frame of the video content and a second sub-frame within a second frame of the video content that is subsequent to the first frame;

receiving focal-point input data indicating a zoom request for a particular dynamic focus point; and

in response to receiving the focal-point input data:

processing the video content, based on the focal-point metadata and the movement metadata, to generate a television video output signal, wherein the movement metadata comprises a motion vector indicating movement of the at least one focus point between the first frame and the second frame, and wherein processing the video content comprises: (a) generating, based on a comparison of the first sub-frame to the second sub-frame, the motion vector indicating movement of the at least one focus point between the first frame and the second frame, wherein the motion vector comprises both a directional component and a magnitude component; and (b) determining, based on the motion vector that indicates movement of the at least one dynamic focus point between the first frame and the second frame, a third subframe that corresponds to an estimated location of the dynamic focus point in a third frame of the video content that is subsequent to the second frame; and

outputting the television video output signal to a graphic display, wherein the television video output signal comprises video content that is zoomed to the particular dynamic focus point in the first, second, and third frames of the video content.

2. The method of claim **1**, wherein the focal-point input data indicating the zoom request is received via a graphical user interface that facilitates a selection of the particular dynamic focus point.

3. The method of claim **1**, wherein at least a portion of the television video transport stream is configured to be displayed at an Ultra HD resolution.

4. The method of claim **1**, wherein the focal-point metadata is provided in separate packets of the standard television video transport stream.

5. The method of claim **4**, wherein the separate packets are provided via an advanced program guide or through MPEG-2 private section packets.

6. The method of claim **1**, wherein the focal-point metadata is provided in a packet header section of a packet.

7. The method of claim **1**, wherein a display format of the television video output signal is a picture-in-picture arrangement, a split-screen arrangement, or a full screen display.

8. The method of claim **1**, further comprising:

receiving video content associated with a plurality of different camera views of the particular television program, wherein the video data from at least one of the plurality of different camera views comprises focal-point metadata regarding the at least one dynamic focus point;

receiving camera selection input data indicating a camera selection request;

processing the video content in response to the camera selection input data; and

generating a television video output signal comprising video content that is associated with one of the camera selection input data, the focal-point input data, and the camera selection input data and the focal-point input data.

9. The method of claim **8**, wherein the one of the camera selection input data, the focal-point input data, and the camera selection input data and the focal-point input data is obtained by way of a graphical user interface that facilitates a selection of one of the camera selection input data, the focal-point input data, or the camera selection input data and the focal-point input data.

10. The method of claim **8**, wherein the focal-point metadata further comprises a focal-point type.

11. The method of claim **10**, wherein the focal-point input data is associated with the focal-point type.

12. The method of claim **11**, further comprising:

receiving focal-point type input data indicating a focal-point type request, wherein the focal-point type input data is obtained by way of a graphical user interface that facilitates a selection of the focal-point type, wherein the input data indicating the zoom request is obtained by way of a graphical user interface that facilitates a selection of the at least one focus point;

processing the video content in response to the focal-point type input data; and

generating a television video output signal comprising video content that is associated with the focal-point type input data, wherein the television video output signal is configured to be displayable on a graphic display.

13. An apparatus, comprising:

a receiver configured to:

receive a video transport stream comprising video content associated with a particular television program, wherein the television video transport stream comprises focal-point metadata indicating at least one dynamic focus point for a zoom function in the video content, wherein the at least one dynamic focus point corresponds to a first sub-frame within a first frame of the video content and a second sub-frame within a second frame of the video content that is subsequent to the first frame;

receive focal-point input data indicating a zoom request for a particular dynamic focus point; and

in response to receipt of the focal-point input data:

process the video content, based on the focal-point metadata and the movement metadata, to generate a television video output signal, wherein the movement metadata comprises a motion vector indicating movement of the at least one focus point between the first frame and the second frame, and wherein processing the video content comprises: (a) generating, based on a comparison of the first sub-frame to the second sub-frame, the motion vector indicating movement of the at least one focus point between the first frame and

the second frame, wherein the motion vector comprises both a directional component and a magnitude component; and (b) determining, based on the motion vector that indicates movement of the at least one dynamic focus point between the first frame and the second frame, a third subframe that corresponds to an estimated location of the dynamic focus point in a third frame of the video content that is subsequent to the second frame; and

output the television video output signal to a graphic display, wherein the television video output signal comprises video content that is zoomed to the particular dynamic focus point in at least the first, second, and third frames of the video content.

14. A method, comprising

receiving a plurality of television video transport streams comprising video content for a particular television program, wherein the plurality of television video transport streams comprises video content associated with a plurality of different camera views of the particular television program, wherein one or more of the plurality of television video transport streams further comprises focal-point metadata indicating at least one dynamic focus point for a zoom function in the video content, wherein the at least one dynamic focus point corresponds to a first sub-frame a first frame of the video content and a second sub-frame within a second frame of the video content that is subsequent to the first frame;

identifying the plurality of different camera views;

receiving camera selection input data indicating a camera selection request;

processing the video content, based on the focal-point metadata, the movement metadata, and the camera selection input data, to generate a television video output signal, wherein the movement metadata comprises a motion vector indicating movement of the at least one focus point between the first frame and the second frame, and wherein processing the video content comprises: (a) generating, based on a comparison of the first sub-frame to the second sub-frame, the motion vector indicating movement of the at least one focus point between the first frame and the second frame, wherein the motion vector comprises both a directional component and a magnitude component; and (b) determining, based on the motion vector that indicates movement of the at least one dynamic focus point between the first frame and the second frame, a third subframe that corresponds to an estimated location of the dynamic focus point in a third frame of the video content that is subsequent to the second frame; and

outputting the television video output signal to a graphic display, wherein the television video output signal comprises video content that is: (a) zoomed to the particular dynamic focus point in the first, second, and third frames of the video content, and (b) associated with the camera selection request.

15. A method, comprising:

receiving streaming data comprising video content associated with at least one live stream for a particular television program;

generating focal-point metadata indicating at least one dynamic focus point for application of a zoom function in the video content, wherein the at least one dynamic focus point corresponds to a first sub-frame within a first frame of the video content and a second sub-frame within a second frame of the video content that is subsequent to the first frame;

generating, based at least in part on a comparison of the first sub-frame to the second sub-frame, movement metadata, wherein the generated movement metadata comprises a motion vector indicating movement of the at least one focus point between the first frame and the second frame, and wherein the motion vector comprises both a directional component and a magnitude component;

generating a television video transport stream comprising: (a) the video content, (b) the focal-point metadata, and (c) the movement metadata; and

transmitting the television video transport stream including the video content and the focal-point metadata indicating the at least one dynamic focus point, by way of a single television channel, so as to facilitate a receiver function to: (i) process the video content, based on the focal-point metadata and the movement metadata, and generate a television video output signal based on the motion vector, wherein the television video output signal comprises a third subframe that corresponds to an estimated location of the dynamic focus point in a third frame of the video content that is subsequent to the second frame, and (ii) output the television video output signal, to a graphic display, wherein the outputted television video output signal comprises video content that is zoomed to the particular dynamic focus point in the first, second, and third frames of the video content.

16. The method of claim **15**, wherein generating focal-point metadata further includes defining a first pair of coordinates as opposing corners of a first box, wherein the first pair of coordinates represents a first sub-frame within a first frame of the video content and defining a second pair of coordinates as opposing corners of a second box, wherein the second pair of coordinates represents a different sub-frame within a second frame of the video content.

17. The method of claim **15**, further comprising:

generating vector metadata indicating the motion vector, wherein the motion vector is determined by comparing a current focus point sub-frame to a previous focus point sub-frame to generate direction data regarding a direction of movement and magnitude data regarding a magnitude of movement.

18. The method of claim **15**, further comprising:

generating identification metadata indicating identification of the at least one live stream; and wherein generating a television video transport stream further includes the identification metadata.

19. The method of claim **15**, wherein the television video transport stream is an Ultra HD video transport stream.

20. The method of claim **15**, wherein generating a television video transport stream further comprises including the metadata in separate packets.

21. The method of claim **20**, wherein the separate packets including the metadata are included in an advanced program guide or are included in an MPEG-2 private section.

22. The method of claim **15**, wherein generating the television video transport stream further comprises including the metadata within the packet header section of a packet.

23. A broadcast system, comprising:

a receiver configured to:

receive streaming data comprising video content associated with at least one live stream for a particular television program; and

a signal-generation system configured to:

receive focal-point metadata that indicates at least one dynamic focus point for application a zoom function in the video content, wherein the at least one dynamic

focus point corresponds to a first sub-frame within a first frame of the video content and a second sub-frame within a second frame of the video content that is subsequent to the first frame, and wherein a motion vector indicates movement of the at least one dynamic focus point between the first frame and the second frame;

generate, based at least in part on a comparison of the first sub-frame to the second sub-frame, movement metadata, wherein the generated movement metadata comprises a motion vector indicating movement of the at least one focus point between the first frame and the second frame, and wherein the motion vector comprises both a directional component and a magnitude component;

generate a television video transport stream that comprises: (a) the video content, (b) the focal-point metadata, and (c) the movement metadata, wherein generating the video content comprises determining, based on the motion vector that indicates movement of the at least one dynamic focus point between the first frame and the second frame, a third subframe that corresponds to an estimated location of the dynamic focus point in a third frame of the video content that is subsequent to the second frame,

transmit the television video transport stream including the video content, the focal-point metadata, and the movement metadata, by way of a single television channel, so as to facilitate a receiver function to process the video content to output a television video output signal, to a graphic display, that comprises video content that is zoomed to the particular dynamic focus point in the first, second, and third frames of the video content.

24. The broadcast system of claim **23**, wherein the receiver is configured to receive the focal-point metadata from the streaming data and send the focal-point metadata to the signal-generation system.

25. The broadcast system of claim **23**, wherein, in order to receive the focal-point metadata, the signal-generation system is configured to generate the focal-point metadata.

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